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Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management
Project Hanford Management Contractor for the
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CONTENTS

FIGURES

TABLES

TERMS

ALARA	as low as reasonably achievable
AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CH	contact handled
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant difference
HANDS-55	Handling and Segregation system for 55-gallon Drums
HMS	Hanford Meteorological Station
OSHA	*Occupational Safety and Health Act*/Administration
OU	operable unit
RAG	remedial action goal
RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act of 1976*
RH	remote handled
ROD	record of decision
Tri-Parties	Tri-Party Agreement signatories
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic (waste materials contaminated with >100 nCi/g of transuranic materials having half-lives longer than 20 years)
TRUPACT-II	Transuranic Package Transporter Model II
VPU	vertical pipe unit
WAC	*Washington Administrative Code*
WIDS	*Waste Information Data System*, Hanford Site database
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Packaging

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1.0 INTRODUCTION

This document describes the project objectives and provides the initial functional parameters and requisite basis to design the systems and facilities required to support remediation activities for the 618-10 and 618-11 Burial Grounds and the unplanned release site UPR-600-22, which are located in the 600 Area of the Hanford Site. The sites are within the 300-FF-2 Operable Unit (OU) and are located approximately 7.2 km (4.5 mi) and 11.26 km (7 mi) north of the 300 Area (Figure 1). The 300-FF-2 OU is located north of the 300 Area near the Columbia River. A brief description of each waste site and its operational history is included in Section 1.3.

Additional details of the proposed remediation activities and the unique challenges at these sites are presented in background documents for this project, including: DOE/RL-99-40, *Focused Feasibility Study for the 300-FF-2 Operable Unit*; EPA/ROD/R10-01/119, *Declaration of the Interim Record of Decision for the 300-FF-2 Operable Unit*, (300-FF-2 OU ROD); *Explanation of Significant Differences for the 300-FF-2 Operable Unit Record of Decision* (300-FF-OU ESD) (EPA 2004); and WMP-17684, *618-10 and 618-11 Burial Ground Remedial Design Technical Workshop Summary Report.*

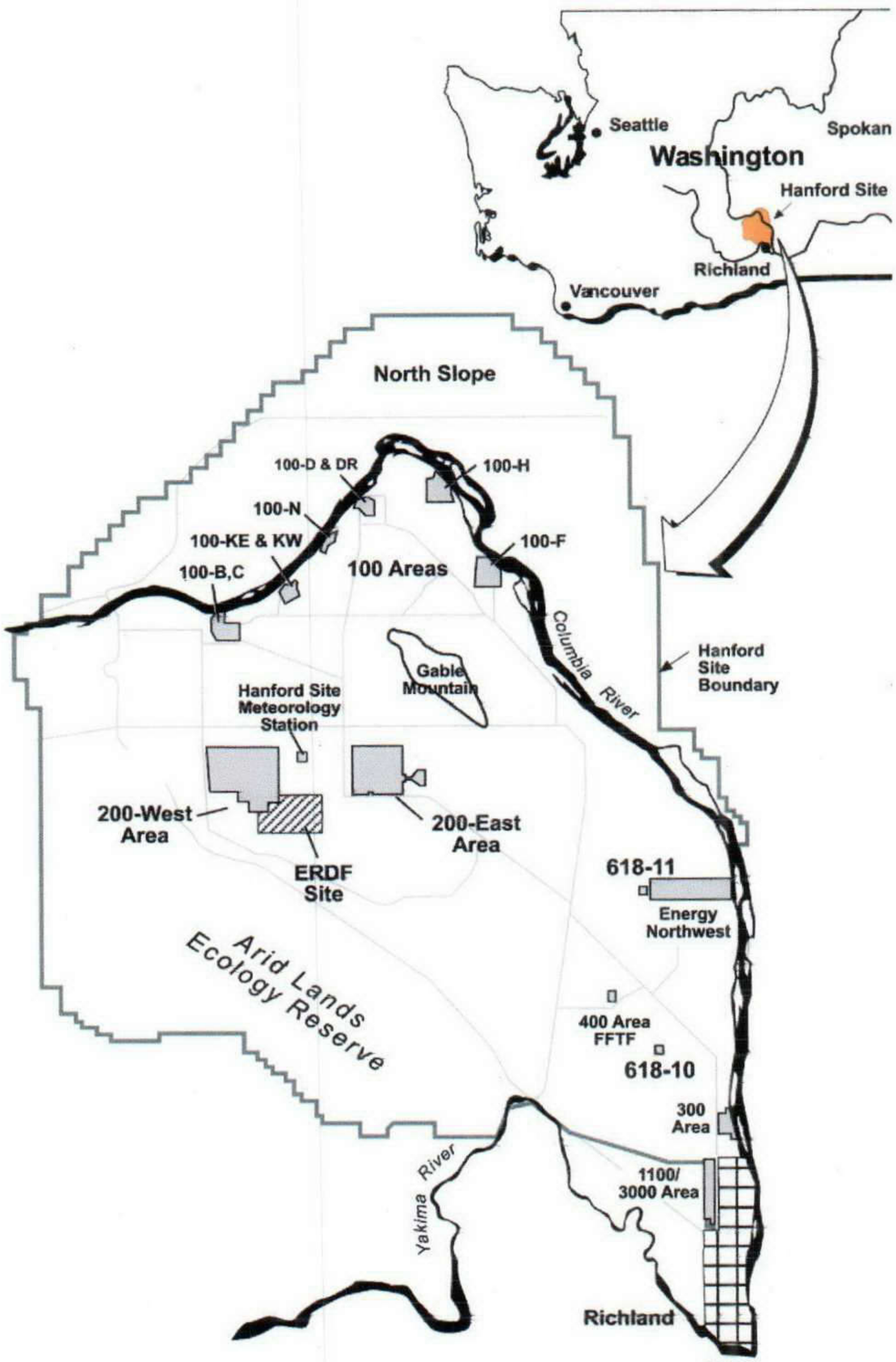
The information contained herein describes the Fluor Hanford understanding of the project objectives and the assumptions and existing conditions to be used in developing the project design. This document is intended to serve as a vehicle for early documentation of Fluor Hanford project objectives and design criteria while the detailed design work progresses concurrently. Design rationale and other supporting information developed during the design will be presented in the remedial design report/remedial action work plan, which will be prepared during the final design stage and will serve as the primary reference document for the project.

1.1 SCOPE

This document establishes the initial design basis and design criteria for the implementation of the remedial action activities at the 618-10 and 618-11 Burial Grounds and the UPR-600-22 site. The work scope for remedial action at the 618-10 and 618-11 Burial Grounds and UPR-600-22 includes the following:

- Perform all necessary activities to remove, treat (if required), and dispose of contaminated soil and debris as specified in the interim action 300-FF-2 OU ROD (EPA/ROD/R10-01/119)
- Establish necessary interfaces with existing site services (utilities and support personnel) and the appropriate waste disposal facilities
- Sample soil and debris to characterize waste, guide remediation, and verify that cleanup goals have been achieved
- Backfill the sites consistent with future use.

Figure 1. Location of the 618-10 and 618-11 Burial Grounds.



The design criteria in this document are applicable to design activities associated with nuclear, non-nuclear, radiological, and industrial waste sites. The detailed technical criteria and the technical approach to project implementation will be consistent with the design criteria provided herein and the health and safety philosophy delineated in Section 4.2 of this document.

1.2 U.S. DEPARTMENT OF ENERGY ENVIRONMENTAL MANAGEMENT RESEARCH RELATED TO TRANSURANIC WASTE

In 1995, the Environmental Management Science Program was developed to create a long-term, basic science infrastructure that would focus on scientific and technical challenges facing the U.S. Department of Energy's (DOE) environmental cleanup efforts. The development of waste delineation, characterization, and retrieval of TRU waste[1] has been pursued through the DOE's Office of Environmental Management and has included such technology and development tests as the Characterization, Monitoring and Sensor Technology Crosscutting Program, the Handling and Segregation System for 55-gallon Drums (HANDS-55), ARROW-PAK Macroencapsulation, Polyethylene Macroencapsulation, Compact High Resolution Spectrometer, Nondestructive Waste Assay Using Combined Thermal Epithermal Neutron Interrogation, Transportable Vitrification System, the Burial Waste Integrated Demonstration Project, and the Mixed Waste Landfill Integrated Demonstration Project, in addition to other technologies.

Other technologies with potential application to the 618-10 and 618-11 Burial Grounds project have been developed in the private sector. While several demonstrations of TRU waste characterization, stabilization, and packaging have occurred, there have been limited demonstrations of waste delineation technologies in actual TRU waste disposal areas. Technologies capable of delineating TRU waste disposal locations have not yet been pursued, and excavation technologies for application at actual TRU waste burial grounds have not been successfully demonstrated.

In 2003, a solicitation for innovative technologies for in situ delineation and excavation of TRU waste at Hanford Site burial grounds was prepared through the DOE National Energy Technology Laboratory. The capability of technology to delineate the burial ground boundaries, the exact location of the waste burial units (i.e., trenches, vertical pipe lines [VPU], and caissons) must be demonstrated before excavation begins. In addition, the characterization technology also should be capable of delineating the physical size of waste masses or containers, the quantity of these waste masses or containers, and the concentration or radiation activity of the wastes to be exhumed. Those technologies that prove effective subsequently will be used at the 618-10 and 618-11 Burial Grounds and might be applicable to sites such as Idaho's Subsurface Disposal Area and other DOE facilities that involve TRU characterization and retrieval. This project will aid in the future selection of excavation technologies for both contact-handled TRU (CHTRU) and remote-handled TRU (RHTRU) waste, will provide lessons learned and potential

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[1] Waste materials contaminated with greater than 100 nCi/g of transuranic materials having half-lives longer than 20 years.

benchmarking that will assist in the refinement of these technologies before full field deployment, and, if successful, will contribute to accelerating the remediation of the two burial grounds.

1.3 LESSONS LEARNED

The DOE implements a lessons-learned program to avoid repeat mistakes and share successful work practices. As part of the DOE Complex-wide initiative, the Lessons-Learned Program aims to improve safety, aid in risk management, enhance cost effectiveness, and encourage process improvement through dissemination, analysis, and use of environmental restoration-related lessons-learned information.

A review has been conducted of the DOE Lessons-Learned database and of those projects related to the excavation and remediation of landfills and burial grounds. Projects that were reviewed include the Idaho National Engineering and Environmental Laboratory Pit 9 Retrieval Project; the Hanford Site Burial Grounds -- 200 East and 200 West Areas, Transuranic Pilot Retrieval Project; the Hanford Site 618-4 and 618-5 Burial Grounds Remediation Project; the Los Alamos National Laboratory Transuranic Waste Inspectable Storage Project; the Oak Ridge 22-Trench Area Transuranic Waste Retrieval Project; the Portsmouth Acid Neutralization Pit Removal Project; the Sandia National Laboratories Chemical Waste Landfill Remediation Project; the Paducah Gaseous Diffusion Plant Project; the East Tennessee Technology Park Low-Level Waste Storage Pad Project; the Rocky Flats Environmental Technology Site Closure Project; and the Oak Ridge National Laboratory Gunite Tank Excavation Project.

Lessons learned from these projects that should be considered during the remediation of the 618-10 and 618-11 Burial Grounds include the following.

- A flexible approach is necessary to achieve the final goal of the project.
- Coordinate with vicinity properties and adjacent landowners.
- A clear understanding is needed of the area of contamination (AOC) boundary. Plan for sufficient operational space needed to stockpile, stage, and store waste.
- Onsite facilities should be designed to accommodate large equipment. The ability for equipment to move with ease in the structures needs to be considered in the design. Building features should include modular structures and the ability to be sealed.
- Work around prevailing winds.
- If new equipment is introduced into the project, consider how the equipment is to be handled and positioned before, during, and after its intended use. New equipment testing and work dry runs should have the level of work control and planning necessary to ensure personnel safety.
- Establish good decontamination and containment procedures.
- Plan for waste minimization.

- "Safely keep waste moving and keep it moving safely."
- Conduct preliminary waste profiling and further define it as the project progresses.
- Project planning must adequately plan for waste not meeting the disposal facility waste acceptance criteria.
- Worker personal protection equipment must be readily available to provide protection from the worst possible hazard material or conditions as identified in the hazard analysis.
- Nuclear criticality safety requirements must be clearly defined and communicated to workers doing fieldwork. A means of physical verification is needed for critical measurements.
- Facility safety programs should implement controls to ensure any operations in and around the facility comply with the safety basis for the facility.
- Personnel must fully understand the potential reactions involving pyrophoric metals. Hazards that could contribute to the severity of a combustible material should be identified by a hazard analysis, and measures to minimize the hazards should be implemented.
- Waste containers should be loaded with radioactive waste in a manner that does not inadvertently cause the external dose to be greater than anticipated, thus exceeding shipping and storage requirements.
- Conscientious review of historical records is vital in understanding the implication of retrieving waste that may affect safe operating procedures. Retrieval plans should include provisions to manage unanticipated situations safely and efficiently.
- Hazard analysis must be an ongoing process that continues throughout the duration of a project. Supervisors and workers must recognize changes in job scope, work practices, methods, or operating conditions. Work plans or activity hazard analysis should contain provisions to temporarily suspend work under such conditions.
- A radiological design review process must be in place to direct and guide the design process and ensure adequate documentation of related as-low-as-reasonably-achievable (ALARA) activities.
- Large, multifaceted projects should have responsibilities clearly defined for ALARA activities, an overall coordinator, and an overall ALARA plan for the project, to ensure consistency between subprojects.
- Plan for abnormal conditions. Have the right plan and controls to address anomalies. Abnormal operational conditions should be incorporated into planning. Consider the possibilities of unknowns and implement controls to mitigate hazards associated with disposal of excavated containers from old landfills and burial sites.
- Have emergency plans in place for internal as well as external situations.

- Involve workers in the planning phase and don't take short cuts when addressing worker concerns.

2.0 SITE BACKGROUND AND OPERATIONAL HISTORY

The Hanford Site was established in 1943 by the U.S. Army Corps of Engineers as an integral part of the Manhattan Engineering District mission to produce nuclear weapons for use in World War II. From 1943 until 1990, the primary mission of the Hanford Site was to produce nuclear materials for the defense of the nation. The Hanford Site had a specific mission: the production of weapons-grade plutonium to fuel the nation's nuclear arsenal. This was accomplished through a three-step process that involved the manufacturing of fuels in the 300 Area, irradiation of fuels in the 100 Area reactors, and extraction and production of plutonium at the chemical separations plants in the 200 Areas. Waste disposal activities associated with this mission resulted in the creation of more than 1,000 waste sites. The waste sites are contaminated with radioactive constituents, chemical constituents, or a combination of both.

Investigation and remediation of these past-practice waste sites is governed by the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) (Tri-Party Agreement), initially signed in 1989 by the DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology). This agreement grouped the waste sites into 78 OUs, each of which was to be investigated and remediated separately under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) program or the *Resource Conservation and Recovery Act of 1976* (RCRA) program, depending on the designation of the OU.

The DOE, EPA, and Ecology have agreed to remediate the 300-FF-2 OU under CERCLA decision documents to facilitate the disposal of contaminated materials at the Hanford Site Environmental Restoration Disposal Facility (ERDF), the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, or other disposal facilities approved in advance by the EPA. Details of the agreement may be found in the 300-FF-2 OU ROD and the 300-FF-2 OU ESD (EPA/ROD/R10-01/119 and EPA 2004).

2.1 WASTE SITE CHARACTERISTICS AND OPERATIONAL HISTORY

During the early years of Hanford Site operations, the 300 Area was tasked with fuels fabrication along with fuel research, testing, and examination. In 1953, the 300 Area laboratories began fuel examination and testing of irradiated fuel rods from the 100 Area production reactors. This type of laboratory analysis created highly radioactive waste, some of which was sent to the 618-10 and 618-11 Burial Grounds for disposal.

The 618-10 and 618-11 Burial Grounds operated between 1954 and 1967 and share the same general characteristics of the general content burial grounds. Important specific characteristics of the 618-10 and/or 618-11 Burial Grounds include the following.

- Both of the burial grounds have an existing cover that consists of soil with vegetation.
- Available records for the 618-10 and 618-11 Burial Grounds indicate that the radionuclide beta/gamma activity generally was divided into three categories for waste

disposal: <10 Ci/ft^3 (low-activity); 10 to 1,000 Ci/ft^3 (moderate-activity); and >1,000 Ci/ft^3 (high activity). The low-activity wastes primarily were disposed of in trenches, while the moderate and high-activity wastes were disposed of in VPUs and caissons. Some of the moderate and high-activity wastes were disposed of in trenches in concrete/lead-shielded drums. For purposes of the focused feasibility study for the 300-FF-2 OU (DOE/RL-99-40), and to be consistent with terms in use today, the portion of the TRU-contaminated waste assumed to have dose rates exceeding 200 mrem/h on contact are considered to be RHTRU.

- The 618-11 Burial Ground contains pre-1970 TRU-contaminated waste buried in VPUs, caissons, and trenches. The reported quantity of plutonium or other transuranic elements in the 618-11 Burial Ground is 5 to 10 kg (11 to 22 lb) dispersed throughout the waste site. The burial ground trenches also contain high-activity waste. The 618-11 Burial Ground is located adjacent to an active commercial nuclear facility that is expected to operate for the next 50 years. In 1987, alternatives for remediation of the waste site were reviewed by the public under the *National Environmental Policy Act of 1969* process in DOE/EIS-0113, *Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes, Hanford Site, Richland, Washington*. The alternative selected in the 1988 *National Environmental Policy Act of 1969* ROD (53 FR 12449, "Record of Decision, Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes") was to proceed with removal and processing of waste from the 618-11 Burial Ground, based on its location outside of the 200 Areas and a DOE desire to consolidate TRU-contaminated waste to the 200 Areas.

- The 618-10 Burial Ground also contains pre-1970 TRU-contaminated waste buried in VPUs and trenches (no caissons). The total quantity of plutonium or other TRU elements within the 618-10 Burial Ground is estimated to be much less than that in the 618-11 Burial Ground (1 to 2 kg [2 to 4 lb]), dispersed throughout the waste site. In addition to a small amount of TRU-contaminated waste, records indicate that the 618-10 Burial Ground trenches also contain high-activity waste and buried drums containing oil. During stabilization activities at the 618-10 Burial Ground in 1983, a noticeable puddle of oil appeared from beneath the soil surface after heavy equipment drove over a portion of the waste site, indicating a potential loss of drum integrity.

- Particulate fallout from burial activities in the 618-11 Burial Grounds contaminated an area outside and adjacent to the north fence of the burial ground (UPR-600-22).

- In January 1999, levels of tritium that greatly exceeded concentrations indicative of the Sitewide tritium plume were identified in a well immediately downgradient of the 618-11 Burial Ground. Another round of sampling in January 2000 revealed a tritium concentration 400 times the drinking water standard (8.1 million pCi/L) in the same well. A multiphase groundwater investigation was immediately launched. Phase 1 (February 2000) involved sampling 22 groundwater wells in a 4.8 to 8km (3 to 5mi) radius of the burial ground. Phase 2 (October 2000) involved resampling 10 wells and installing two temporary groundwater sampling points and a series of soil-gas sampling points (to monitor tritium releases in the vadose zone). The results of the analysis identify the 618-11 Burial Ground as the primary source of the tritium plume in the groundwater and suggest that the extent of the plume is highly localized. The groundwater investigation is ongoing, and any active groundwater responses will be authorized through an amendment to the 300-FF-5 ROD (EPA/ROD/R10-96/143, *Declaration of the Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units*) (the 300-FF-5 OU addresses groundwater beneath the 300-FF-1 and 300-FF-2 OUs). DOE also is evaluating options for interim measures that can be taken to address the source of the plume in the burial ground before the removal/treatment/disposal remedy selected in this ROD can be implemented.

The following is a description of each waste site and its operational history. Information included in these descriptions was taken from CP-14592, *618-10 and 618-11 Waste Burial Grounds Basis for Interim Operations*, historical engineering drawings, and the most current *Waste Information Data System* (WIDS) general summary reports.

2.1.1 618-10 Burial Ground

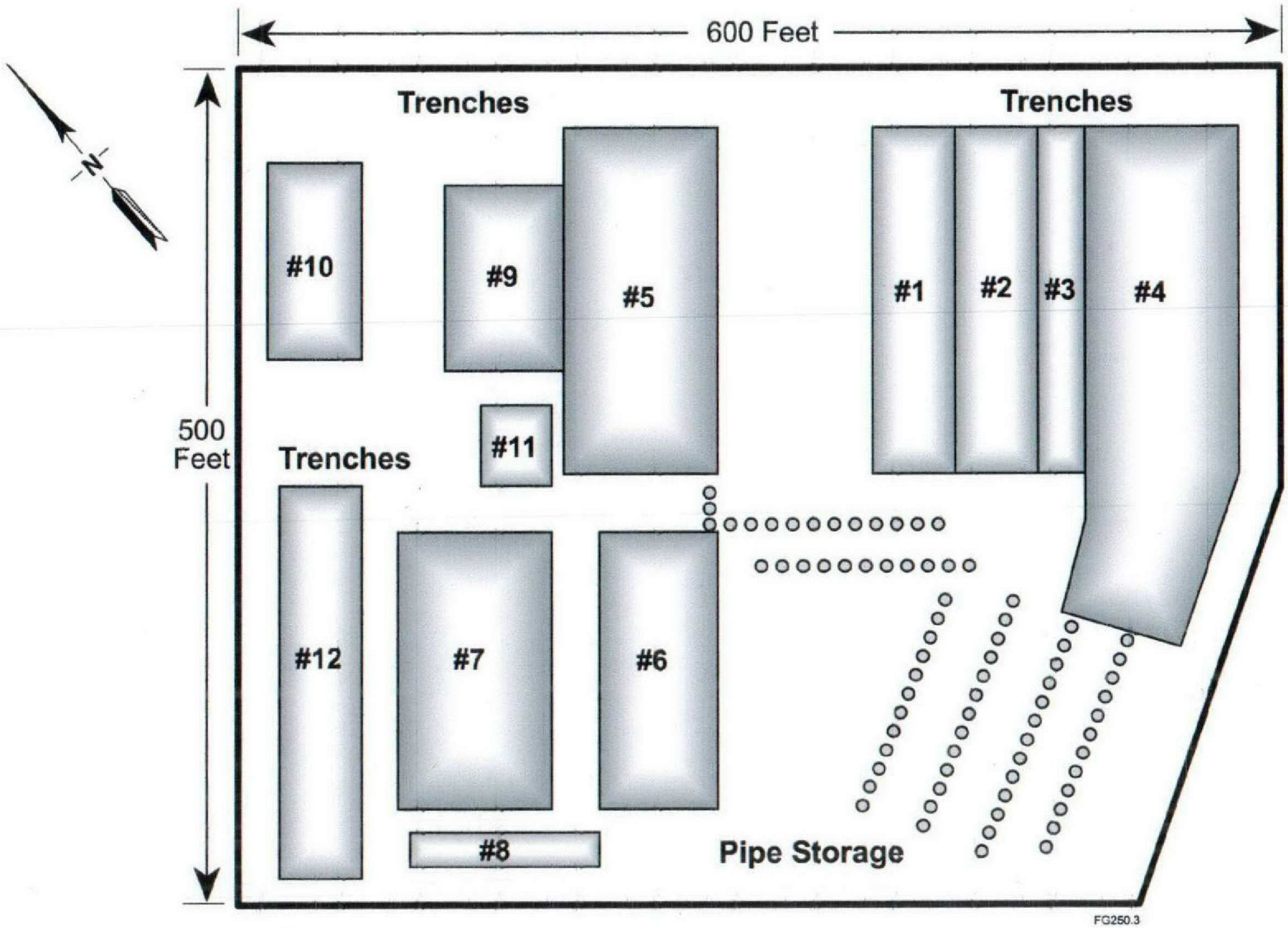
The 618-10 Burial Ground site consists of 12 trenches and 94 VPUs, as shown schematically in Figure 2. The trenches range in size from 97 m (320 ft) long by 21 m (70 ft) wide by 7.6 m (25 ft) deep to 15 m (50 ft) long by 12 m (40 ft) wide by 7.6 m (25 ft) deep. The VPUs are 56 cm (22-in.) diameter, 4.6 m (15-ft) long waste receptacles constructed by welding together five 55-gal bottomless drums end-to-end and burying them vertically. The burial site was covered in soil when it was closed. Records do not indicate the exact amount of soil used, but it is assumed to be 0.6 m (2 ft), which is the same amount used at the 618-11 Burial Ground site. An additional 0.6 m (2 ft) of soil was added to the site for surface stabilization in 1983.

2.1.1.1 Operating History – 618-10 Burial Ground

An estimated 3,680 to 5,670 m^3 (4,800 to 7,400 yd^3) of waste material was buried at the 618-10 Burial Ground site, approximately 8.4 m^3 (11 yd^3) of which are equivalent to RHTRU, according to DOE/RL-99-40. Radiological and chemical hazards include cesium, strontium, plutonium, americium, neptunium, beryllium, uranium, zirconium, sodium-potassium metals, and oils/solvents.

Wastes received were generated mostly by the 308 Fuels Development Laboratory, 321 Hydromechanical/Seismic Facility, 325 Radiochemical Processing Laboratory, 326 Materials Science Laboratory, 327 Post Irradiation Test Laboratory, 328 Office and Maintenance Buildings, 329 Chemical Sciences Laboratory, 3211 Building, 3707 Change House, 3741 Special Machine Shop, and 3746 Irradiation Physics Building. Most of the waste resulted from 300 Area laboratory operational activities. Wastes included radiologically contaminated laboratory instruments, bottles, boxes, filters, aluminum cuttings, irradiated fuel element samples, metallurgical samples, electrical equipment, lighting fixtures, barrels, laboratory equipment and hoods, and low- and high-level liquid waste sealed in containers.

Figure 2. The 618-10 Burial Ground.



The exteriors of the waste containers were surveyed before the containers were transported to the 618-10 Burial Ground site. The actual contents of the containers are not known with certainty, but radiological survey records indicate the number of waste shipments and the types of containers used. Trenches generally received low-level waste in cardboard boxes. Materials with higher radioactivity were packaged in cement barrels (concrete and lead-shielded drums). From the mid-1950s to about 1960, radioactive wastes were packaged in cardboard containers and stored in lead pans referred to as "gunk catchers." Contaminated materials were often carried to the burial ground in "load luggers," which could hold approximately 5.7 m^3 (200 ft^3) of loose waste. Around 1960, the radioactivity of the disposed waste from the 325 and 327 Laboratory hot cells increased because of the examination, at the laboratories, of fuel rod and tank waste samples. Cardboard containers and gunk catchers were replaced with remote-handled milk pails, paint cans, and juice cans. The containers were remotely loaded into lead-shielded casks for transport to the burial grounds. The waste was remotely released from the cask to the VPUs.

The 618-10 Burial Ground site had three documented unplanned releases during operation of the burial site and one documented unplanned release during the addition of soil in 1983. The first release occurred in 1961 and was caused by a fire in a trench. The fire destroyed all flammable material in the affected trench, including approximately 200 boxes of contaminated material and several high-efficiency particulate air filter-type cooling-water-system filters. Contamination was spread at a distance of 15.2 to 21.3 m (50 to 70 ft) outside the fenced area. The trench was covered with dirt after the fire was extinguished.

The second release occurred in 1963 and involved a truck driver who was found to be contaminated after completing a burial of "milk cans" at the 618-10 Burial Ground site. Traffic was diverted to allow Environmental Monitoring to survey the road for possible contamination. The survey of the road between the burial ground and the 327 Post Irradiation Test Laboratory building found one spot of contamination in front of the 384 Powerhouse in the 300 Area. No contamination was found on the highway. An area in front of the burial ground gate was contaminated and a 1.5 m (5-ft) radius around the VPU was contaminated.

The third release, also in 1963, resulted from an improperly sealed container being dropped into a VPU. The lid came off the container, causing a spread of contamination measuring approximately 55.7 m^2 (600 ft^2) around the VPU.

The last release incident at the 618-10 Burial Ground site occurred during the addition of soil used to stabilize the area. During the soil hauling operations, a truck drove over a trench area, and what appeared to be oil came to the surface. This incident indicates that, at a minimum, one container within the area has been breached. The approximately 9.3 m^2 (100 ft^2) of soil was found to be contaminated, with levels to 10,000 c/min.

The 618-10 Burial Ground site stopped receiving waste in September 1963 and was surface stabilized with 0.6 m (2 ft) of clean backfill material in 1983.

2.1.2 618-11 Burial Ground

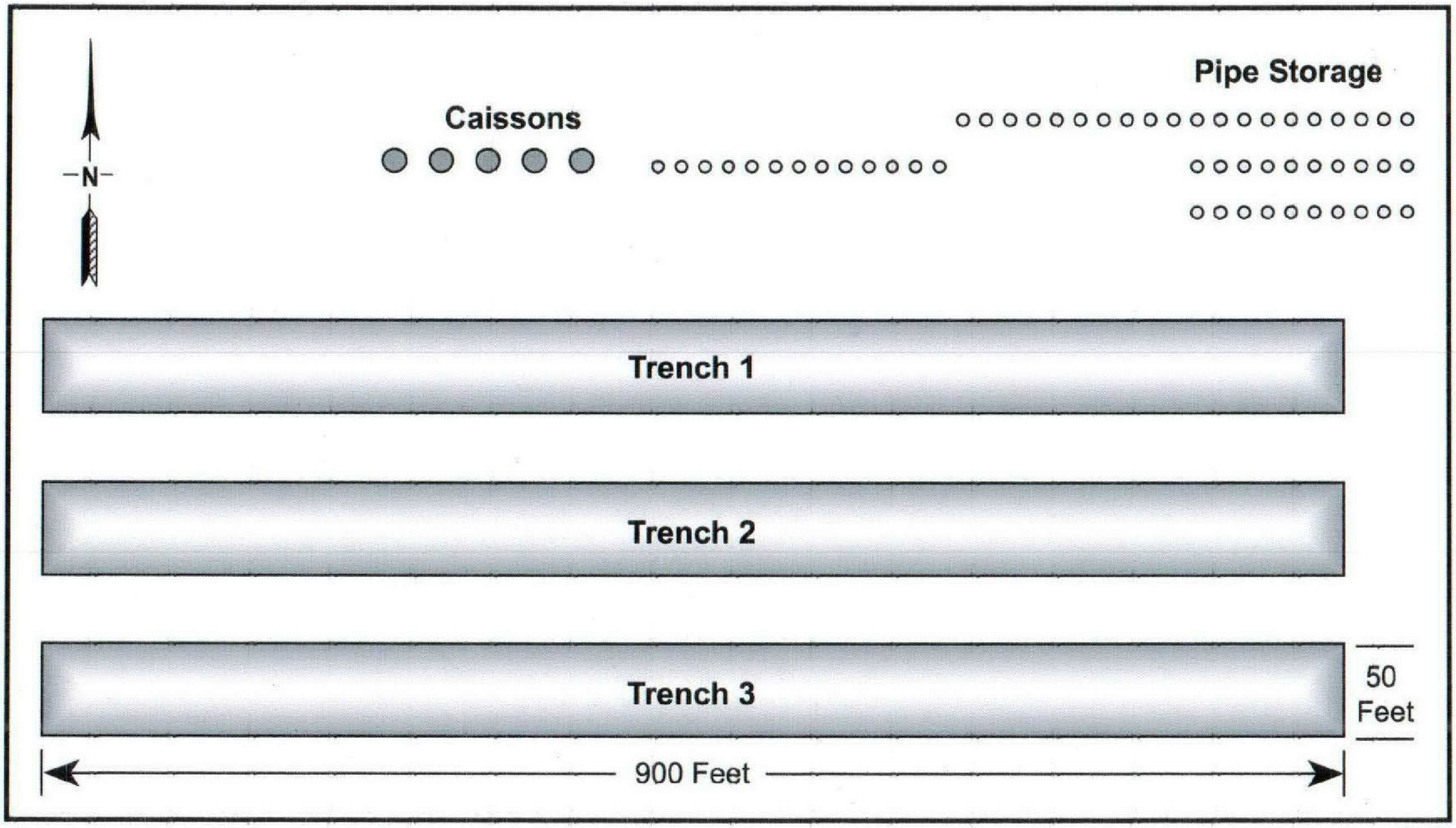
The 618-11 Burial Ground site consists of 3 slope-sided trenches, 3 to 5 large caissons, and 50 VPUs. Figure 3 is a schematic drawing of the site. The trenches are 270 m (900 ft) long by 15 m (50 ft) wide and 7.6 m (25 ft) deep. The 50 VPUs are 56 cm (22-in.) diameter, 4.6 m (15-ft) long waste receptacles constructed by welding together five 55-gal bottomless drums and burying them vertically with approximately 3 m (10 ft) of spacing between the units. The units are open to the soil at the bottom. The large-diameter caissons were constructed of 2.4 m (8-ft) diameter corrugated metal pipe, 3 m (10 ft) long, with the top of the caisson 4.6 m (15 ft) below grade, and connected to the surface by an offset 91 cm (36-in.) diameter pipe with a dome cap lid. These units were buried with approximately 4.6 m (15 ft) of space between them. The caissons were open to the soil at the bottom. The number of caissons is questionable because of contradictions in site documentation. A geophysical survey performed in 1995 indicated that up to 5 additional caisson units of unknown size may exist at the 618-11 Burial Ground. The burial ground received a minimum of 0.6 m (2 ft) of soil when it was closed in 1967. This was in addition to the soil cover used to close the trenches. An additional 0.6 m (2 ft) of soil was added to the site for surface stabilization in 1983.

2.1.2.1 Operating History – 618-11 Burial Ground

The 618-11 Burial Ground site was opened in March 1962 and accepted waste to Trench 1 until October 3, 1962. The burial ground was then taken out of service pending U.S. Atomic Energy Commission review and approval of the 618-11 Burial Ground location. During the closure period, a second trench and 40 VPUs were added. The burial ground was brought back online when the 618-10 Burial Ground went through closure at the request of the U.S. Atomic Energy Commission. Trench 3 was added after the burial ground was reopened, along with an additional 10 VPUs and 3 to 5 caissons. Trench 3 had not been completely filled with waste at closure of the 618-11 Burial Ground site in December 1967.

The site contains a broad spectrum of low-level waste including fission products, byproduct material (thorium and uranium), and plutonium. The site was used for the disposal of 300 Area laboratory solid wastes. Low-activity wastes were received from the following facilities: 303 Buildings, 305 Engineering Test Facility, 306 Building, 309 Plutonium Recycle Test Reactor, 313 N Fuels Manufacturing Support Facility, 321 Hydromechanical/Seismic Facility, 324 Chemical Engineering Building, 325 Radiochemical Processing Laboratory, 325-A Cesium Recovery Facility, 325-B Shielded Laboratory Annex, 326 Materials Science Laboratory, 327 Post Irradiation Test Laboratory, 329 Biophysics Laboratory, 333 N Fuels Building, 340 Waste Neutralization Facility Complex, 3706 Communication and Documentation Building, 3707-C Safeguards and Security Maintenance Shop, 3718 Office and Storage Building, 3730 Gamma Irradiation Facility, and 3732 Storage Building. These facilities all handled radioactive contaminated, or potentially contaminated, waste from operations or laboratory areas, including hot cells. Moderate- and high-activity (remote-handled) waste was received from the 327 Building radiometallurgy hot cells, 325-A Building hot cells, the 325-B Building (analytical) hot cells, occasionally from the 309 Plutonium Recycle Test Reactor Building, and later from324 Building hot cells. The low- to moderate-activity dry solid wastes were disposed to trenches (with some exceptions), and the moderate- to high-activity wastes were disposed to VPUs and caissons. The 325-A Building hot cells disposed of moderate- to high-activity waste to the trenches in concrete

Figure 3. The 618-11 Burial Ground.



lead-shielded drums. The 325-B Building hot cells also used concrete-shielded drums to dispose of hot-cell waste, used laboratory containers and glassware, and spent instruments and equipment. Some plutonium residues were encapsulated in concrete and placed in lead and concrete-shielded drums at the 325 Building by 340 Building operators servicing various organizations and facilities, including the 308 Fuels Development Laboratory Building.

A tritium plume has been detected outside the fenced area of the 618-11 Burial Ground site. A groundwater investigation is on-going. However, previous analysis has indicated that the 618-11 Burial Ground is the source of the plume.

The 618-11 Burial Ground site had seven documented unplanned releases during its operational life. In September 1963, a milk pail container that was externally contaminated with a significant amount of loose, highly radioactive material was discharged into a caisson, causing a contamination spread. Although the wind was less than 10 mi/h, an area of contamination was identified that measured approximately 36 m^2 (400 ft^2) around the caisson. The cask truck had smearable contamination on the inside of one tire.

In March 1964, a trailer truck hauling two waste casks from the 327 Post Irradiation Test Laboratory Building attempted to deposit waste into a VPU. As a waste can was dropped into the VPU, a "blowback" of radioactive material occurred, contaminating four employees, the vehicle, and approximately 90 m^2 (1,000 ft^2) of ground on the site.

In May 1964, a contamination incident occurred while dumping canned waste from the 325 Radiochemical Processing Laboratory Building from a waste cask. The waste truck was positioned over a VPU, and the waste chute was opened. Fine white powder was seen drifting out of the chute. Two employees were contaminated, along with approximately 167 m^2 (1,800 ft^2) of ground adjacent to the VPU.

In February 1965, wind blew waste from a truck, and a worker and the ground surrounding the truck were contaminated. The area of contaminated ground was approximately 130 m^2 (1,400 ft^2).

In March 1965, during the burial of a box containing a highly contaminated filter from the 327 Post Irradiation Test Laboratory Building, an employee became contaminated. The truck was positioned at the burial trench and the truck bed was tilted. The employee left the truck cab to see why the box would not slide off the truck and noticed clouds of dust emitting from the box seams. The employee was contaminated and the immediate area received spotty contamination.

In April 1967, during routine burial operations, a contamination spread occurred involving waste from the 327 Post Irradiation Test Laboratory Building that was being deposited into a VPU through a chute from a cask. The operation was being performed from the upwind side of the cask. At the moment that the waste was dropped into the chute, the wind reversed in a strong gust, causing the airborne spread of contamination. Three employees were contaminated, along with the transport truck, and approximately 2.7 m^2 (30 ft^2) of ground.

Also in April 1967, during routine burial operations, a piece of waste became wedged in a truck chute, causing an airborne release of contamination. The waste was being transported in a new 4,500 kg (5-ton) cask. After the waste was released from the cask to a VPU, the dose rate at the

bore of the cask remained at the initial level of 450 mrad/h, indicating that some of the waste did not clear the cask. A water rinse of the cask bore had no effect in reducing the dose rate.
A worker taped a plastic cover over the head of the cask and withdrew from the area. Three employees were found to have skin contamination. Two pickup trucks were contaminated.
A survey of the ground found contamination in a fan shape with maximum levels of 50 mrad/h. Contamination was found outside the fenced area. The ground around the VPU, inside the fence, was covered with clean gravel. The contaminated area outside the fence was turned over into windrows with a bulldozer, to bury the contamination and prevent it from blowing away. The area was posted with radiation signs but later was released from radiation zone status. The area outside the fence is known as UPR-600-22, WPPSS Windrow Site.

2.1.3 Unplanned Release Site UPR-600-22

The site is located west of the Energy Northwest facility (formerly referred to as WPPSS) adjacent to the north fence of the 618-11 Burial Ground. Information from WIDS states that an area, approximately 1.2 km^2 to 1.6 km^2 (3 to 4 acres) in size, was contaminated with particulate fallout from burial activities before 1972. The contamination subsequently was covered by scraping the affected area into windrows.

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3.0 PROJECT DESIGN BASIS

3.1 PURPOSE

This section presents the governing regulations, codes, and design standards that will be followed in developing the preliminary design for the system and facilities required to support remediation activities. The project objectives and goals as defined in the 300-FF-2 OU ROD (EPA/ROD/R10-01/119) and in the 300-FF-2 OU ESD (EPA 2004) and the selected remedy to address the burial grounds and the unplanned release site also are discussed.

3.2 CLIENT REQUIREMENTS

The purpose of this project is to provide the client with the remedial design requirements for the remediation of the 618-10 and 618-11 Burial Grounds and the UPR-600-22 site. An "Issue for Bid" design package will be prepared. Upon completion of the design effort, an "Issued for Construction" design package, stamped by a Washington State-licensed professional engineer, will be completed. The work scope will be performed in accordance with state and Federal regulations and guidance, including but not limited to CERCLA, Tri-Party Agreement, Occupational Safety and Health Administration (OSHA), DOE orders, the 300-FF-2 OU ROD (EPA/ROD/R10-01/119), the 300-FF-2 OU ESD (EPA 2004), and other related guidance.

3.3 ROLES AND RESPONSIBILITIES

Roles and responsibilities for this project are defined in HNF-RD-14988, *Project Management Requirements*; HNF-GD-14989, *Project Management Guidance*; and HNF-PRO-14990, *Construction Management*. Roles and responsibilities for the design are defined in HNF-RD-1819, *PHMC Engineering Requirements*.

3.4 DESIGN DEVELOPMENT PROCESS

The interim action 300-FF-2 OU ROD (EPA/ROD/R10-01/119) and the 300-FF-2 OU ESD (EPA 2004) have established remedial action objectives (RAO) and remedial action goals (RAG) for cleanup of the 300-FF-2 OU waste sites. The interim action 300-FF-2 OU ROD (EPA/ROD/R10-01/119) and 300-FF-2 OU ESD (EPA 2004) criteria and requirements will be incorporated into the remedial design report/remedial action work plan for the project.

A graded approach will be implemented as part of the design process to meet the support facilities and infrastructure requirements. Commercial design standards and practices will be used whenever possible. The design process will follow the principles of HNF-MP-003, *Integrated Environment, Safety and Health Management System Description*.

Key activities occurring concurrent with the design (e.g., cultural/ecological review) will provide additional input. Additionally, the data documented in individual reports or interoffice memoranda will be incorporated. Applicable data resulting from the performance of these tasks will be incorporated into the design requirements. Applicable data also will be incorporated directly into the appropriate design media (e.g., design drawings, specifications, volume calculations, WIDS updates, waste profiles) or regulatory documents (e.g., remedial design report/remedial action work plan).

Any additional design criteria, requirements, codes, and standards that are not specifically addressed in this document will be developed and/or incorporated into the applicable design media (e.g., drawings, specifications, statement of work) during the remedial design process.

3.4.1 Remedial Action Objectives (Industrial and Unrestricted Land-Use)

The 300-FF-2 OU ROD (EPA/ROD/R10-01/119) requires that waste sites be remediated to industrial cleanup levels as well as be protective of ecological receptors, groundwater, and river water quality. Since issuing the 300-FF-2 OU ROD (EPA/ROD/R10-01/119), the Tri-Party Agreement signatories (Tri-Parties) have evaluated the additional cleanup necessary to achieve unrestricted cleanup levels for waste sites outside the "core industrial zone". Based on the evaluation, the 300-FF-2 OU ESD (EPA 2004) was issued. The 300-FF-2 OU ESD (EPA 2004) provides notice of a change to uranium cleanup levels identified in the 300-FF-2 OU ROD (EPA/ROD/R10-01/119) and modifies soil cleanup levels for eight outlying waste sites within the 300-FF-2 OU from industrial to unrestricted cleanup levels. One of these waste sites is the 618-10 Burial Ground.

The RAOs provide a basis to evaluate the capability of a specific remedial alternative to achieve compliance with applicable or relevant and appropriate requirements (ARAR) and/or an intended level of risk protection for human health or the environment. Their overall purpose is to help ensure that selected remedial actions will be protective of human health and the environment by removing contaminants, reducing their levels, and/or by eliminating or minimizing exposure pathways. Specific RAOs for the 300-FF-2 OU were defined in the 300-FF-2 OU ROD (EPA/ROD/R10-01/119) and were defined based on the fate and transport of buried wastes, projected land uses for the 300 Area, and the 300-FF-2 OU conceptual exposure model. The 300-FF-2 OU ESD (EPA 2004) does not generally change the RAOs identified in the 300-FF-2 OU ROD (EPA/ROD/R10-01/119), although risk levels for individual chemical and radiological contaminants are modified to reflect the unrestricted land-use scenario. The 300-FF-2 OU ESD (EPA 2004) changes the land-use scenario for the 618-10 Burial Ground under which the 300-FF-2 OU ROD (EPA/ROD/R10-01/119) RAOs must be met.

The RAOs for the 300-FF-2 OU waste sites are as follows.

1. Prevent or reduce risk to human health, ecological receptors, and natural resources associated with exposure to wastes or soil contaminated above ARARs or risk-based criteria. For radionuclides, this RAO means prevention or reduction of risks from exposure to waste or contaminated soil that exceeds the CERCLA cumulative excess

cancer risk range of 10^{-4} to 10^{-6}.[2] For chemicals, this RAO means prevention or reduction of risks from direct contact with waste or contaminated soil that exceed the *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act -- Cleanup," cumulative excess cancer risk goal of 10^{-5} cancer risk and/or a hazard index of 1.[3] For sites subject to the unrestricted land-use scenario, cleanup levels for individual chemical constituents are based on a 10^{-6} excess cancer risk.

2. Prevent migration of contaminants through the soil column to groundwater and the Columbia River such that concentrations reaching groundwater and the river do not exceed maximum contaminant levels under Federal and/or state drinking water standards (40 CFR 141, "National Primary Drinking Water Regulations"; WAC 246-290, "Department of Health," "Public Water Supplies"), ambient water quality criteria under 40 CFR 131, "Water Quality Standards," (Federal Clean Water Act)[4], and/or WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington," and WAC 173-340-720, "Ground Water Cleanup Standards."

3. Prevent or mitigate health and occupational risks to workers performing remedial action.

4. Minimize the general disruption of cultural resources and wildlife habitat and prevent adverse impacts to cultural resources and threatened or endangered species.

5. Provide conditions suitable for future industrial and unrestricted land-use of the 300 Area.

6. Ensure that appropriate institutional controls and monitoring requirements are in place to protect future users of a remediated site (e.g., industrial and unrestricted land-use scenarios).

3.4.2 Remedial Action Goals

The RAGs are contaminant-specific numerical cleanup criteria developed to ensure that the remedial actions to be implemented will meet the RAOs. To achieve RAOs, numerical cleanup levels for industrial and unrestricted land use were calculated and promulgated by the 300-FF-2 OU ROD (EPA/ROD/R10-01/119) and in the 300-FF-2 OU ESD (EPA 2004). Contaminant-specific cleanup levels may differ for individual waste sites based on site-specific conditions (e.g., land-use, size of the waste site, nature and extent of contamination in the soil column) or to achieve the overall RAOs for the 300-FF-2 OU (e.g., cumulative risk from multiple

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[2] The Tri-Parties have chosen 15 mrem/yr above background over a period of 1,000 years after final remediation for a maximally exposed individual to address this RAO. Meeting this objective will also be protective of ecological receptors based on criteria specifying that dose rates shall not exceed 0.1 rad/day for terrestrial organisms and 1.0 rad/day for aquatic organisms and terrestrial plants.

[3] Direct contact values may have to be adjusted further to be protective of terrestrial plants and animals depending on the location of the individual waste site and the nature of the surrounding habitat.

[4] For most radionuclides, maximum contaminant levels correspond to a cumulative dose of 4 mrem/yr.

contaminants, protection of the groundwater, and/or protection of the Columbia River). Changes to contaminant-specific cleanup levels will require advance approval by the EPA and documentation in the verification/closeout reports for individual waste sites.

To accomplish the objective for development of individual RAGs that are protective of human health and the environment at a generic waste site, the following goals were considered:

- Protection of human or ecological receptors from direct exposure to source materials (including external radiation, dermal contact, ingestion of soil, and inhalation of fugitive dust)
- Protection of groundwater resources
- Protection of surface water resources.

Numeric soil RAGs were developed independently for each of the four pathways, based on generic site parameters, and subsequently were compared to each other to identify the most restrictive value and select a RAG that is protective of all pathways. Previous ecological risk assessments performed in the 300 Area indicate that actions taken to protect human health also are protective of ecological receptor populations, especially in areas of industrial use.

Based on historical 300 Area operations and characterization information, a comprehensive list of potential contaminants was identified for the 300-FF-2 OU. Although RAGs were developed for each of the potential contaminants, it should be emphasized that these contaminants will not necessarily be found at each waste site. Some of the potential contaminants may not be found at any of the waste sites. A brief discussion of the assumptions used in the calculations of the cleanup levels for both the industrial land-use and the unrestricted land-use scenarios is given in the subsections below. A complete discussion of the RAGs for both scenarios is presented in the focused feasibility study for the 300-FF-2 OU (DOE/RL-99-40) and the 300-FF-2 OU ESD (EPA 2004).

3.4.2.1 Cleanup Levels for Industrial Land-Use (618-11 Burial Ground and UPR-600-22)

The industrial land-use scenario assumes that an adult worker is located in the area of residual contamination for approximately 1,500 h/yr inside a building and 500 h/yr outdoors for a period of 30 yr. For radionuclides, the 300 Area industrial land-use scenario assumes that the exposure pathways for residual contamination will be direct exposure to radiation; ingestion of soil containing residual contamination; and inhalation of particles in the air from residual contamination. It is assumed that drinking water is not obtained from groundwater sources and food products are not grown on site.

Cleanup levels for chemicals in the 300 Area industrial land-use scenario are based on WAC 173-340-745, "Soil Cleanup Standards for Industrial Properties," which assumes that the exposure pathway for residual contamination will be from ingestion of contaminated soil. For both carcinogens and noncarcinogens, the levels assume that a person weighing 70 kg (154 lb) ingests soil at a rate of 50 mg/day (18.25 g/yr) with a contact frequency of 40 percent and a gastrointestinal absorption rate of 100 percent. For carcinogens, the calculation is based on achieving a lifetime cancer risk goal of 1 x 10^{-5} for an exposure duration of 20 yr and a lifetime of 75 yr. For noncarcinogens, the calculation is based on achieving a hazard quotient of 1.

It also is assumed that (1) no sensitive human subpopulations (e.g., children) are permitted to come into contact with residual soil or debris contamination from waste sites (i.e., the cleanup levels are based on exposures to adults); (2) the period of analysis for evaluation of site risks and groundwater protection is 1,000 years; and (3) direct exposure of onsite workers to residual contamination to a depth of 4.6 m (15 ft) may occur (this represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities).

3.4.2.2 Cleanup Levels for Unrestricted Land-Use (618-10 Burial Ground)

The 300 Area unrestricted land-use scenario is identical to the 100 Area unrestricted or rural-residential land-use scenario, which is represented by an individual in a rural residential setting. The individual is conservatively assumed to spend 80 percent of his/her lifetime on site. It is assumed that the resident will consume and irrigate crops raised in a backyard garden and will consume animal products (e.g., meat, milk) from locally raised livestock. The exposure pathways considered in estimating dose from radionuclides in soil are inhalation; soil ingestion; ingestion of crops, meat, fish, drinking water, and milk; and external gamma exposure. It is assumed that drinking water and irrigation water are obtained from groundwater impacted by the waste site.

Cleanup levels for chemicals or nonradionuclides in the 300 Area unrestricted land-use scenario are based on WAC 173-340-740(3), "Unrestricted Land Use Soil Cleanup Standards," "Method B Soil Cleanup Levels for Unrestricted Land Use," which assumes that the exposure pathway for residual contamination will be from ingestion, inhalation, and consumption of contaminated groundwater. Soil cleanup levels are calculated using the equations provided by WAC 173-340-740(3) for carcinogens and noncarcinogens. For both carcinogens and noncarcinogens, the calculations assume that a resident with an average body weight 16 kg (35 lb) over the period of exposure ingests soil at a rate of 200 mg/day (73 g/yr), with a frequency of contact of 100 % and a gastrointestinal absorption rate of 100 %. For carcinogens, the calculation is based on achieving a lifetime cancer risk goal of 1 in 1,000,000 (1 x 10^{-6}) for an exposure duration of 6 yr and a lifetime of 75 yr. For noncarcinogens, the calculation is based on achieving a hazard quotient of 1.

On the same basis that is described under the industrial land-use scenario, it is assumed that the period of analysis for evaluation of site risks and groundwater protection is 1,000 yr, and direct exposure of onsite residents to residual contamination to a depth of 4.6 m (15 ft) may occur (this represents a reasonable estimate of the soil depth that could be excavated and distributed at the soil surface as a result of site development activities).

3.5 SELECTED REMEDY

The selected remedies for the 618-10 and 618-11 Burial Grounds and the UPR-600-22 unplanned release site, as specified in the interim action 300-FF-2 OU ROD (EPA/ROD/R10-01/119), include the following:

- Removal of contaminated soil, structures, and associated debris
- Treatment, as necessary, to meet waste acceptance criteria at an acceptable disposal facility
- Disposal of contaminated materials at the Hanford Site ERDF, the WIPP in Carlsbad, New Mexico, or other disposal facilities approved in advance by the EPA
- Recontouring and backfilling of excavated areas followed by infiltration control measures (e.g., revegetation)
- Institutional controls to ensure that unanticipated changes in land use do not occur that could result in unacceptable exposures to residual contamination
- Ongoing groundwater and ecological monitoring to ensure the effectiveness of the remedial actions and to support the final 300-FF-2 OU ROD (EPA/ROD/R10-01/119) and five-year remedy reviews.

3.6 GOVERNING REGULATIONS, CODES, STANDARDS, AND GUIDES

Regulatory requirements comprise the relevant Fluor Hanford, DOE, state, and Federal requirements including the latest revisions of procedures, codes, and standards. These provide the requirements used in the preparation of design documents, as applicable to the removal/treatment/disposal activities. The following sources will govern the preparation of design documents for the 618-10 and 618-11 Burial Grounds and the UPR-600-22 unplanned release site:

- DOE requirements
- Federal, state, local, and industry design codes and regulations
- Fluor Hanford and Hanford Site design standards and guides, as applicable
- Health and safety requirements.

Various orders, standards, and guidelines have been promulgated by DOE Headquarters and the DOE, Richland Operations Office to guide contractor activities. Unless otherwise noted, the design and construction of the facilities used to support remediation activities will be based on applicable sections of the codes and standards, regulations, and other referenced documents listed in Table 1. The list below is not all-inclusive. Additional applicable regulatory requirements may be cited, and any revision of codes and standards will be used as determined by project-specific requirements.

Guidance for using the codes and standards referenced in this document is included in HNF-PRO-8258, *Functional Design Criteria*, Appendix B, "Guidance for Selecting National Codes and Standards." Where design standards are not dictated by the Project Hanford Management Contract standards/requirements identification document infrastructure, the national consensus codes and standards will be used.

Table 1. U.S. Department of Energy and Fluor Hanford Requirements. (2 Pages)

U.S. Department of Energy Order or Requirement [a]	Implemented in Fluor Hanford Procedures, Requirements, or Guidance [a]
DOE Order 420.1A, *Facility Safety*	HNF-8663, *Fluor Hanford Requirements Management Functional Area Document* HNF-7098, *Criticality Safety Program* HNF-5053, *Fluor Hanford Safety and Health Policy*
DOE Order 435.1, *Radioactive Waste Management*	HNF-GD-8260, *Chemical and Waste Management Interface*
DOE Order 460.1B, *Packaging and Transportation Safety*	HNF-RD-7900, *Transportation and Packaging Program Requirements* HNF-PRO-156, *Onsite Hazardous Material Shipments*
DOE Order 5480.4, *Environmental Protection, Safety, and Health Protection Standards*	HNF-5054, *Fluor Hanford Environmental Policy* HNF-RD-15332, *Environmental Protection Requirements* HNF-5053, *Fluor Hanford Safety and Health Policy*
DOE Order 231.1A, *Environment, Safety, and Health Reporting*	HNF-RD-15332, *Environmental Protection Requirements* HNF-5053, *Fluor Hanford Safety and Health Policy*
DOE Order 5400.5, *Radiation Protection of the Public and the Environment*	HNF-5173, *PHMC Radiological Control Manual*
DOE Order 414.1B, *Quality Assurance*	HNF-MP-599, *Quality Assurance Program Description* HNF-PRO-261, *Quality Assurance Program Plans*
DOE/E/1830-T5, *A Guide to Reducing Radiation Exposure to As Low As Reasonably Achievable (ALARA)*	HNF-5053, *Fluor Hanford Safety and Health Policy* HNF-RD-7769, *OSHA Compliance*
DOE-EM-STD-5502-94, *DOE Limited Standard Hazard Baseline Documentation*	HNF-PRO-079, *Job Hazard Analysis* HNF-GD-17916, *Industrial Hygiene Baseline Hazard Assessment*
DOE/RL-92-36, *Hanford Site Hoisting and Rigging Manual*	HNF-5053, *Fluor Hanford Safety and Health Policy*
DOE-STD-1088-95, *Fire Protection for Relocatable Structures*	HNF-RD-9118, *Fire Protection Design/Operations Criteria* HNF-RD-10606, *Fire Protection Program Requirements*
DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*	HNF-PRO-8366, *Facility Hazard Categorization* HNF-RD-8316, *Safety Basis Requirements*

[a] Full citation of references is provided in Chapter 5.0.

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4.0 PROJECT DESIGN CRITERIA

This section presents a brief description of the major components of the remedial action and the design requirements/criteria that will be used in the preliminary design. For the purpose of this discussion the remedial design has been divided into four areas: 1) functional requirements required to support remediation; 2) health and safety requirements; 3) excavation and backfilling; and 4) waste management.

4.1 FUNCTIONAL REQUIREMENTS

Functional requirements include support services and facilities designed to facilitate implementation of the design. Functional requirements may include temporary trailers and/or structures, telephone service, power supply, water/sewage facilities, and roadway construction.

A central support facility will provide office/work space and services for a field support team (e.g., supervisors, engineers, and technicians). The remediation sites for the 618-10 and 618-11 Burial Grounds and UPR-600-22 will have designated areas for contractor and subcontractor support trailers and/or temporary structures. The temporary facilities will be placed on level, compacted gravel surfaces, using previously disturbed areas to the maximum extent possible. Subcontractor equipment, staging areas, and container transfer facilities will be established in accordance with the final "issued for construction" project drawings. Cultural and ecological evaluations and identification of monitoring well locations will be conducted before final facility and infrastructure siting decisions are made.

All facilities and infrastructures necessary to support the project will be designed and sited so as to minimize and/or avoid impacts to cultural and natural resources.

4.1.1 Temporary Facilities

Except as specifically otherwise noted, all facilities supporting the remediation activities will be considered to be temporary and will comply with the applicable parts of WAC 296-150F, "Labor," "Factory-Built Housing and Commercial Structures." Temporary facilities are defined as facilities erected as a construction aid. Temporary facilities are removed when construction is completed. This definition does not apply to semitrailers and cargo containers.

4.1.1.1 Natural Phenomena Hazards

Mobile offices, trailers, and temporary structures will be designed and supported to the requirements of the current version of the *Uniform Building Code* (ICBO 1997) and WAC 296-150F.

Wind loads will be based on ANSI/ASCE 7-02, *Minimum Design Loads for Buildings and Other Structures*, for a basic wind speed of 38 m/s (85 mi/h). This basic wind speed corresponds to a 3-second gust speed at 10 m (33 ft) above ground in "Exposure Category C" and is associated with an annual probability of 0.02 of being equaled or exceeded (50-yr mean recurrence interval).

Snow loads will be considered for the design of structures and utilities in accordance with provisions of ANSI/ASCE 7-02, Section 7.0. In general, 73.3 kg/m^2 (15 lb/ft^2) will be used as ground snow load, but in no case will roofs be designed for less than a 97.7 kg/m^2 (20 lb/ft^2) snow load.

Facilities will be designed according to the requirements of the *Uniform Building Code* (ICBO 1997) for seismic zone 2B.

The effects of extreme temperature will be considered as applicable. The most extreme temperatures recorded at the Hanford Site were a high of 45 °C (113 °F) and a low of -32.8 °C (-27 °F). Heat tracing will be considered for liquid lines subject to freezing. If a facility is not operational, lines, tanks, or components containing water will be designed so they can be drained easily.

Facilities will be designed in accordance with the live load requirements defined in the *Uniform Building Code* or applicable WAC rules and regulations.

4.1.1.2 Fire Protection

Fire protection requirements for relocatable structures are given in DOE-STD-1088-95, *Fire Protection for Relocatable Structures*, as implemented in HNF-RD-9118, *Fire Protection Design/Operations Criteria.*

All temporary structures constructed or set up within the remediation sites for the 618-10 and 618-11 Burial Grounds and UPR-600-22 will be equipped with hand-held fire extinguishers as emergency fire protection. The Hanford Fire Department will provide primary fire protection. The requirements of DOE-STD-1088-95 will be used as a guideline, because none of the conceived temporary facilities have attributes requiring a higher standard of protection.

4.1.2 Power and Electrical

Any extension or reactivation of existing utility services to support these facilities will be temporary. Electrical power will be supplied by the contractor to a location close to the designated areas for subcontractor-supplied support facilities (i.e., the Fast Flux Test Facility and Energy Northwest). After remediation activities are complete, the temporary electrical utility services constructed or installed by the subcontractor will be deactivated and decontaminated (as required) and may be removed by the subcontractor.

Portable generators may be used where extension of the existing service is not practical or cost effective. Portable generators or extensions of existing electrical infrastructure will comply as a minimum to the *National Electric Code* (NEC) from the National Fire Protection Association requirements (NFPA 2002) including all necessary inspections.

All temporary power equipment including receptacles, circuits, disconnects, and conductors will be of ample size to carry the anticipated load. Grounding circuits will be checked to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the circuit breaker to interrupt the current. Ground fault circuit interrupters will be installed in accordance with the most recent edition of the *National Electric Code* (NFPA 2002). Outdoor receptacles in wet locations will be contained in weatherproof enclosures.

The International Code Council's *2003 ICC International Electrical Code* (ICC 2003) and the Institute of Electrical and Electronics Engineers' *National Electrical Safety Code*® (IEEE 2002), as implemented HNF-PRO-481, *Electrical Utilities Interface Agreement with Facilities/Plants*, and HNF-RD-11827, *Hanford Electrical Safety Program Requirements,* will be followed in performing all design and construction activities associated with electrical tie-ins and power line relocations.

Significant modifications to existing electrical designs will include a load survey to determine the size and adequacy of components in accordance with recognized standards. Normal power systems and wiring will be designed in accordance with recommended practices, as implemented in HNF-RD-11827. Applicable calculations also will be developed to support design and equipment sizing.

All electrical equipment will be grounded in accordance with the *2003 ICC International Electrical Code* (ICC 2003), the *National Electric Code* (NFPA 2002), and the *National Electric Safety Code*® (IEEE 2002), as implemented in HNF-PRO-481 and HNF-RD-11827.

4.1.3 Water

Water from existing mains is not potable and, therefore, will be used only for fire protection, decontamination processing, dust suppression, and other nonconsumptive uses. The contractor will provide potable water for the central support facility. As applicable, the subcontractor will provide potable water at the remediation sites for human consumption and washing, via large and small storage tanks or by installing new lines that connect to existing water lines at nearby facilities (i.e., the Fast Flux Test Facility and Energy Northwest). Controls for water and ice will be in accordance with applicable sections in WAC 246-290, as implemented in HNF-PRO-14566, *Infrastructure/Water Utilities Furnished Services*. Potable and nonpotable piping and fixtures must be adequately identified with placards to ensure proper use.

4.1.4 Telephone

Telephone and telecommunication (computer) service will be provided by microwave link or by existing land cable. If new telephone lines are required, cellular telephones will be used until new land lines are installed. Cellular telephones also will be used in areas where the lines will not or cannot be extended.

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4.1.5 Sanitary Service

Where existing sanitary sewer services (e.g., lines, tanks, leaching fields) are no longer in service, sanitary waste from the temporary support facility will be collected in holding tanks. Sewage holding tanks are subject to the substantive requirements of WAC 246-272, "Department of Health," "On-Site Sewage Systems," as implemented in HNF-RD-15332, *Environmental Protection Requirements*, and HNF-PRO-15333, *Environmental Protection Processes*. Rollaway septic tanks are considered an approved equal, although a waiver must be filed with and accepted by the State of Washington before they are installed. The subcontractor will be required to provide portable toilets at each of the active remediation sites. Sanitary waste from the central support facility will use existing waste collection and treatment systems, as available. New lines may be installed and connected to existing sanitary sewer services at facilities (i.e., Fast Flux Test Facility and Energy Northwest) located near the burial grounds. If existing sanitary waste systems are not available for the central support facility, the sanitary waste also will be collected in holding tanks.

4.1.6 Roads

Access roads will have an unobstructed driving-surface width and load-bearing capacity to withstand the loads of fire department and other emergency vehicles under all weather conditions.

Temporary roads may be required for access and haulage in support of the project activities. The width of temporary roads will be based on the required service. However, the width will not be less than 3.66 m (12 ft) for one-way traffic and 6.71 m (22 ft) for two-way roads. Road surfacing will be crushed stone pavement. Adequate provisions will be made to control dust as necessary. Minimum compaction of the subgrade and top layer will be 90 percent of the modified maximum dry density to a depth of 30.5 cm (12 in.) below the roadway surface (ASTM D1557-02, *Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))*).

Permanent roads will be designed and constructed in accordance with the requirements of WSDOT M21-01, *Standard Plans for Road, Bridge, and Municipal Construction*. Minimum compaction of the subgrade and top layer will be 95 percent of the modified maximum dry density to a depth of 61 cm (24 in.) below the asphalt section (ASTM D1557-02).

4.1.7 Fencing

Fencing will be limited to that required for safety and activity control. In each case, the most economical type of fencing that will satisfy the particular functional requirements will be selected.

4.1.8 Protective Lighting

Protective lighting, as part of a security system, will be provided as needed. Lighting for security in working spaces, access ways, and corridors, etc., will be in accordance with Illuminating Engineering Society standards.

4.2 HEALTH AND SAFETY

The safety issues related to remediation activities concern heavy equipment operation, material handling, excavation safety, personnel exposure, emergency response and preparedness, working in contaminated materials, extreme weather conditions, and ensuring that workers do not exceed *Occupational Safety and Health Act of 1970* (OSHA) permissible exposure limits (29 CFR 1910, "Occupational Safety and Health Standards") during excavation. All design will be performed in accordance with any and all restrictions, controls, and requirements outlined in the controlling authorization-basis documents, including the basis for interim operation (CP-14592) and the safety evaluation report (CCN 0302893, "Transmittal of 618-10 and 618-11 Waste Burial Grounds Safety Evaluation Report and Technical Safety Requirements,") approved by the DOE, Richland Operations Office. The following subsections provide the safety principles embodied in the design criteria to meet project activity safety requirements and are consistent with the safety provisions promulgated by DOE.

4.2.1 Personnel Safety Requirements

The main safety issues related to remediation activities concern proper heavy equipment operation, material handling, and working in extreme weather conditions. All excavation and material-handling equipment will meet safe operating requirements as specified by OSHA in 29 CFR 1910 and 29 CFR 1926, "Safety and Health Regulations for Construction," as applicable. Only qualified personnel will be allowed to operate equipment.

A related issue is the potential exposure of workers, through excavation of the waste site, to contaminants that must not exceed OSHA permissible exposure limits (29 CFR 1910). To ensure that workers are adequately protected from the above potential hazards, the requirements of HNF-5053, *Fluor Hanford Safety and Health Policy*, and HNF-MP-003 will apply to remediation activities. A site specific health and safety play will be prepared to provide direction for health and safety measures specific to the remedial action scope.

To protect worker health, excavations will be established and posted in accordance with the requirements of HNF-5173, *PHMC Radiological Control Manual.* Radiation protections will be conducted pursuant to 10 CFR 835, "Occupational Radiation Protection." A radiation work permit will be prepared as part of the design planning activities.

4.2.1.1 Personal Protective Equipment

Personal protective equipment will be selected to protect employees from the physical and toxic effects of chemical hazards. Personal and area monitoring to detect chemical hazards, radiological hazards, noise, heat stress, or oxygen deficiency will be conducted when the presence of these hazards is indicated by the hazards assessment. Industrial hygiene monitoring systems will have sufficient accuracy and sensitivity to determine compliance with limits established in 29 CFR 1910.1000, "Occupational Safety and Health Standards," "Air Contaminants," and the current threshold limit values established by the American Conference of Governmental Industrial Hygienists.

The industrial hygiene protection design criteria will comply with applicable portions of 29 CFR 1926 and 29 CFR 1910, as implemented in HNF-5053 and HNF-MP-003.

4.2.1.2 Occupational Radiation Protection

Radiation protection design criteria will be in accordance with applicable portions of 10 CFR 835, as implemented in HNF-5173. Measures will be taken to maintain radiation exposure in controlled areas through physical design features and administrative controls.

During routine operations, the combination of physical design features and administrative controls will enable the following:

- The anticipated occupational dose to general employees will not exceed the limits established in 10 CFR 835.202, "Occupational Radiation Protection," "Occupational Dose Limits for General Employees"
- The ALARA process is used for personnel exposures to ionizing radiation.

Design criteria for radiological protection will be consistent with applicable Federal and state regulations. The criteria also will be consistent with recognized standards, guidelines, and DOE directives related to radiological safety in the design.

4.2.1.3 Control of External Radiation Exposure

The design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupancy will be to maintain exposure levels below an average of 0.5 mrem/h and as far below this average as is reasonably achievable.

The design objective for exposure rates for potential exposure to a radiological worker where occupancy differs from the above will be ALARA and will not exceed 20 percent of the applicable standards in 10 CFR 835.202.

One or more of the following features will be used for each entrance or access point to a high radiation area, where radiation levels exist such that an individual could exceed a deep dose equivalent to the whole body of 1 rem in any hour at 30 cm (11.81 in.) from the source or from any surface that the radiation penetrates:

- A control device that prevents entry to the area when high radiation levels exist or that, upon entry, causes the radiation level to be reduced below that level defining a high-radiation area
- A device that functions automatically to prevent use or operation of the radiation source or field while individuals are in the area

- A control device that energizes a conspicuous visible or audible alarm signal so that individuals entering the high-radiation area and the supervisor of the activity are made aware of the entry
- Continuous direct or electronic surveillance that is capable of preventing unauthorized entry.

4.2.2 Personnel Frisking and Decontamination

All personnel will be required to decontaminate after exiting the contamination area and before entering the radiological buffer area. The frisking and decontamination building will be located in the contamination reduction zone and will include wash and disposal facilities for personal protective equipment. The facility will provide workers with shelter from the sun, wind, rain, and snow and will make provisions available to maintain radiological survey instrumentation.

4.2.3 Monitoring Requirements

To minimize the potential for radiological and chemical contamination spread, engineering and administrative controls will be employed using best available radionuclide control technology and/or ALARA controls.

Air monitoring will be conducted pursuant to the following requirements:

- WAC 246-247, "Department of Health," "Radiation Protection -- Air Emissions"
- 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"
- RCW 70.94, "Public Health and Safety," "Washington Clean Air Act"
- WAC 173-400, "General Regulations for Air Pollution Sources"
- WAC 173-460, "Controls for New Sources of Toxic Air Pollutants"
- WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides."

The air-monitoring program will determine if radiological and chemical contaminants are present as suspensions of solid particles with unacceptable occupational exposure levels. Power for air monitoring equipment will be supplied by portable generators, existing electrical sources, or newly installed electrical hookups and will be operated continuously throughout the duration of the remedial action. Air monitors will be placed in locations that will monitor work processes and meteorological conditions and will be used to determine when air contaminants become a threat to unprotected workers in the contamination reduction zone or the support zone or to those offsite.

Monitoring of radiological and chemical contaminants will be conducted on site using a combination of hand-held and fixed-mounted detectors. Detectors will be used to guide excavation in accordance with the observational approach to remediation. Laboratory analysis of radiological and chemical contaminates also will be performed as needed. The contaminant data will be entered into all appropriate databases and used for guiding remedial excavation, staging the waste, packaging the waste, adjusting waste profiles, and providing backup data to support completion of waste tracking forms.

Events that may warrant an increase in air monitoring frequency and/or the number of air monitoring stations may include but are not limited to the following:

- Action levels are exceeded in the contamination area
- Populations are downwind of the contamination area during intrusive work
- Visible emissions (e.g., dust) are blowing toward other populated facilities
- Odor complaints are received.

4.2.4 Emergencies

In the event of unforeseeable emergencies, safe distances and places of refuge (i.e., muster points) will correlate to the wind direction, the topography, and the incident/emergency. Personnel will be advised to move to an upwind location from any fires and/or chemical and radiological releases and will be advised to continually monitor wind direction for changes. If moving upwind from these types of incidents is not possible without encountering the incident and subsequent exposure potential, personnel will be advised to move crosswind or downwind to a distance necessary to be out of the path of smoke, odors, or releases. During personal injury/illness incidents (unless they involve fires or chemical releases), distances from incidents will be such as to prevent interference with emergency response.

Each day, muster points will be designated based on wind speed, wind direction, and planned activities. Muster points may change when wind speed and direction change. When this occurs, new muster points will be communicated via 2-way radio. Designated muster points will be marked appropriately.

4.2.5 Communication

Health and safety issues will be communicated quickly and efficiently to all affected project team members and nearby workers. To meet this requirement, several communications processes will be implemented.

Communication may be facilitated by the use of radios, pagers, cellular phones, and emergency siren and horns. Health and safety messages will be communicated through the use of signs and bulletin boards. A safety bulletin board will be maintained in the project trailer. Safety-related signs will be posted in accordance with OSHA regulations and Hanford Site requirements.

4.3 EXCAVATION AND BACKFILL

Excavation and backfill of the 618-10 and 618-11 Burial Grounds and the UPR-600-22 unplanned release site require equipment operations in uncontaminated and contaminated soil of varying physical properties (i.e., fine sand to boulders and buried debris of varying sizes) (DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*; DOE/RL-96-42, *Limited Field Investigation Report for the 300-FF-2 OU*). Burial Grounds 618-10 and 618-11 have been used as disposal areas for waste that is TRU or low-level mixed waste. The probability of excavating RHTRU waste along with CHTRU waste is high. UPR-600-22 was not used as a disposal area. This area was contaminated during an unplanned release at the 618-11 Burial Ground site. Detailed estimates of material removal from all three sites will be developed during the design phase.

4.3.1 Environmental/Climatological Data

The Hanford Site lies within the semiarid shrub-steppe Pasco Basin of the Columbia Plateau. The regional temperatures, precipitation, and winds are greatly affected by the presence of mountain barriers. The Hanford Meteorological Stations (HMS) are a function of the Meteorological and Climatological Services Project funded by the DOE. This project is responsible for providing ongoing meteorological and climatological data to the DOE and Hanford Site contractors. These data are necessary to ensure that operations and activities on the Hanford Site are conducted safely, particularly where specific weather conditions might affect those operations or activities.

The HMS is located between the 200 East and 200 West Areas. Thirty automated monitoring stations, which are part of the Hanford Meteorological Monitoring Network, are located within and near the Hanford Site. There are seven automated stations within an 8 km (5 mi) radius of the 618-10 and 618-11 Burial Grounds: Prosser Barricade (Station #1), Fast Flux Test Facility (Station #9), 300 Area (Station #11), Wye Barricade (Station #12), WNP-2 (Station #14), Franklin County (Station #15), and HAMMER (Station #30).

Monthly average temperature data for 2003, provided in PNNL-14616, *Hanford Site Climatological Data Summary 2003 with Historical Data*, for the seven automated stations, indicate that temperatures range from a maximum of 27.2°C (80.9°F) in July to a minimum temperature of 0.9°C (33.6°F) in December. Monthly average precipitation during 2003 ranged from 43.9 mm (1.73 in.) in January to no precipitation being measured during the months of June and July (PNNL 14616). Prevailing wind directions in the area of the 618-11 Burial Ground during 2003 were from the south, with the monthly average wind speeds varying from a maximum of 13.8 km/h (8.6 mi/h) in March to a minimum of 8.0 km/h (5.0 mi/h) in January (PNNL 14616). Prevailing wind directions in the area of the 618-10 Burial Ground during 2003 were from the south/southwest, with the monthly average wind speeds varying from a maximum of 16.1 km/h (10 mi/h) in March to a minimum of 7.9 km/h (4.9 mi/h) in January (PNNL 14616).

4.3.2 Civil Surveys

Survey and datum information will be provided on drawings in accordance with HNF-RD-709, *Preparation and Control Standards for Engineering Drawings*:

- Site boundaries
- Site grade
- Datum elevation
- Coordinates
- Survey control points
- Grid north based on the Washington State Plane Coordinate System.

Standards of accuracy for all survey work will be in accordance with Federal Geodetic Control Committee standards as set forth in WAC 332-130, "WAC Natural Resources, Board and

Department of," "Minimum Standards for Land Boundary Surveys and Geodetic Control Surveys and Guidelines for the Preparation of Land Descriptions." The datum for horizontal control network must be NAD83, *North American Datum of 1983*, and must be NAVD88, *North American Vertical Datum of 1988*, for vertical control network.

4.3.3 Excavation

Pre-excavation activities including establishing site utility services, construction of roads, field support facilities, radiological survey and decontamination stations, and interim waste staging and storage facilities, and stripping of the existing vegetation and overburden material will be conducted as necessary to prepare the site for excavation.

Excavation activities will involve removing clean and contaminated soil, debris, and anomalous waste present within the burial ground boundaries. During waste-site excavation, the actual side slope required to prevent cave-ins and/or sloughing will vary, with differences in such factors as materials that have been previously disturbed, excavation depth, soil type, environmental conditions of exposure, location of personnel, and application of surcharge loads near the excavation. Guidance for each excavation will be determined in accordance with the requirements of 29 CFR 1910 and 29 CFR 1926, Subpart P, "Safety and Health Regulations for Construction," "Excavations," and HNF-PRO-090, *Excavating, Trenching, and Shoring*. Shoring, sheeting, bracing, and/or sloping will be installed and maintained as required by OSHA and other applicable regulations. This will be used to support the sides of the excavation to prevent damage to adjacent roadways and structures or to prevent endangering the health and safety of personnel.

During site operations, no equipment will be operated within a 3-m (10-ft) radius of energized power lines with nominal voltage below 50 kV. For power lines with nominal voltage above 50 kV, the distance required will be in accordance with 29 CFR 1910.333, "Occupational Safety and Health Standards," "Selection and Use of Work Practices." Equipment and excavated material will not be placed near the edge of an excavation. Open excavations will be secured from unnecessary access by the placing of adequate physical barriers around the area. Access/egress from the excavation will be provided in accordance with OSHA (29 CFR 1910 and 29 CFR 1926).

4.3.4 Drainage/Erosion Control

During excavation layout and preliminary civil land survey, local topography will be mapped to determine if precipitation run-on/run-off potential exists and if appropriate measures (e.g., installation of earthen berms) must be taken. Excessive run-on from surrounding areas could affect slope stability and has the potential to spread contamination. Berms and channels will be provided around the excavation and associated waste materials storage and container transfer areas, to interrupt and direct water away from any accumulation areas.

If water does accumulate in soil removal traffic areas or storage, transfer, or excavation areas, operations will be suspended until the affected area dries up or until standing water is removed.

Any standing water pumped from the area will be treated as waste until characterization can be performed and proper disposal approval has been received.

4.3.5 Dust Suppression

Visible dust emissions from the sites are not permitted. Dust from excavation and haul operations will be controlled through engineering and administrative controls. Controlled locations include, but are not limited to, the limits of the excavation, roads, parking areas, and container transfer areas and storage areas. Active excavations will use water or other methods as approved for dust control in accordance with consultant agreements between the DOE Richland Operations Office, the EPA, and the Washington State Department of Health. Water use for dust control will be minimized to protect against contaminant migration. Crusting agents or fixants will be applied to any disturbed portion of the contamination area that will be inactive for more than 24 hours. Material to be disposed of at the ERDF also will comply with the moisture content and other applicable requirements of BHI-00139, *Environmental Restoration Disposal Facility Waste Acceptance Criteria.* Wind and precipitation information will aid in excavation planning.

4.3.6 Backfill

When the RAOs have been met and verified, the sites will be backfilled. Each site will be backfilled to match the slope and elevation of adjacent existing ground. Backfill compaction and gradation will be included in the technical specifications that will be developed during the final design planning phase. Backfill material will have the same soil consistency as native material to allow for proper soil permeability.

Some uncontaminated fill will be provided from onsite sources, with the remainder from local borrow pits. Borrow material for the site may be taken from approved areas of the Hanford Site.

4.3.7 Soil and Waste Characterization

Soil and waste characterization will be based on the observational approach, which relies on available historical information and limited field investigation combined with a "characterize-and-remediate-in-one-step" methodology. Field screening methods and/or sampling results will be used to support soil and waste characterization during remedial action. The in situ or on-location measurements will support the following:

- Excavation guidance
- Waste segregation and classification
- Waste characterization, shipment, and disposal requirements
- Basis for site closeout sampling.

The following characterization concepts form the basis for the characterization strategy. A data quality objectives summary report and a sampling and analysis plan will be prepared to provide the requirements for remedial action sampling and analysis.

4.3.7.1 Characterization and Waste Designation

The extent of radiological contaminants will be established on site using a combination of hand-held and fixed-mounted sodium iodide and high-purity germanium detectors. Additional alpha and beta detectors may be used as determined by the project radiological engineer. These detectors will be used to guide excavation in accordance with the observational approach to remediation. The contaminant data will be entered into all appropriate databases and used for guiding remedial excavation, packaging the waste, adjusting waste profiles, and providing backup data to support completion of waste tracking forms.

Chemical characterization data will be obtained by discrete soil sampling, with analysis provided by a contract laboratory. The laboratory will follow protocols provided in the most recent approved version of SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Third Edition; Final Update III-A*. All laboratory results will be entered into a database to support remedial-action-site closeout decisions and contaminated waste disposal. Chemical field-screening methods may be used and will follow methods specified in GRP-EE-05-1.0, *Routine Field Screening*, or other methods specified in the project sampling and analysis plan.

4.3.7.2 Limited Characterization

Limited subsurface examination of some portions of the sites may be conducted, if required, to reduce levels of uncertainty before remedial excavation begins or as the excavation proceeds. The goals of the subsurface examinations will be to provide data to support the development of waste profiles in accordance with the ERDF and/or WIPP waste acceptance criteria and to identify uncertainties that could impact remediation activities.

Field investigation activities may include test pit excavation, treatability testing, technology demonstration programs, field radiological testing, collection/analysis of samples, and surface geophysical survey of selected excavation areas. Findings from the field investigations will be incorporated through a revision of this document and internal office memoranda, as needed.

4.3.8 Equipment Decontamination

Excavation of waste materials may contaminate the equipment used for removal, processing, and disposal of the wastes. Equipment will be removed from the contaminated zones only for replacement, maintenance, or moving to a new site. Routine decontamination should not be necessary. When equipment is transferred from contaminated areas to uncontaminated areas, surveys and decontamination may be required. The equipment used for waste handling/separation must be amenable to the survey and decontamination methods, which also will be practical and cost effective to implement.

A portable frisking and decontamination station will be located at the egress of the contamination area. The structure will provide all-weather protection for radiological survey equipment and for site workers. Adequate ventilation will be provided to prevent accumulation of exhaust and fumes from vehicles and equipment.

Equipment found to be radioactively contaminated will undergo a progressive decontamination process until release limits are attained. Decontamination activities will be in accordance with HNF-5173. The first attempts at decontamination will consist of a wipe down with dry or damp adsorbents. If this process is unsuccessful, items will be decontaminated using high-pressure water or steam cleaners.

If generated, rinsate from decontamination activities will be used for dust suppression on contaminated waste in the AOC that will be sent to the ERDF. Additionally, decontamination water may be used as process water for treatment technologies if treatment is necessary. If fixed contamination is encountered during the decontamination process, abrasive techniques such as grinding, needle gunning, or cutting will be performed. The degree of containment necessary for such abrasive techniques will depend on contamination levels on the item. As a general guide, items with fixed contamination below 100,000 disintegrations/minute/100 cm^2 will not require full enclosure while decontamination is in progress.

If decontamination techniques are not effective in removing fixed radiological contamination and/or the equipment does not meet the radiological release limits, the equipment will remain at the Hanford Site and may be used at other sites undergoing remedial action.

4.3.9 Mitigation

Mitigation refers to a series of prioritized actions designed to minimize or lessen potential impacts to cultural or natural resources. In areas that contain surface contamination and that are located in ecologically or culturally sensitive areas, alternatives to large-scale excavation should be exercised, such as hand removal of the debris. All efforts to remain within the existing footprint of each site should be made. Before excavation activities are started, ecological and archaeological surveys will be performed to locate exclusion area boundaries.

Sites in areas of minimal disturbance, or minimally disturbed areas surrounding heavily disturbed areas, may have early successional-stage vegetation developing over gravelly and fine-grained soils. Some of these vegetated areas may need to be used for transportation corridors, support facilities, and material storage areas.

4.3.10 Site Revegetation

Decisions concerning final revegetation of remediated and/or disturbed sites depend on future land use, remediation goals, cost, achievability, and results from previous revegetation work. Site revegetation plans will be developed in consultation with the Native American community. A revegetation plan for the 300 Area has been developed in DOE/RL-2001-47, *Remedial Design Report/Remedial Action Work Plan for the 300 Area* that may be applied at these sites.

4.4 WASTE MANAGEMENT

Waste from the excavation sites will be containerized (as appropriate) and transported for storage, treatment (if required), and/or disposal. Contaminated material will be loaded directly into an appropriate transportation container or stockpiled for temporary storage. With the exception of containers of material potentially designated as dangerous waste, containers may be staged for pick-up at a container transfer facility near the excavation. Containers with potentially dangerous waste will remain within the project boundaries or will be transported to a dangerous waste storage area. Additionally, containers with CHTRU and RHTRU waste may be transported to the Waste Receiving and Processing (WRAP) facility or the M-91 facility on the Hanford Site for processing and staging pending final disposal. (M-91 refers to a series of defined milestones in the Tri-Party Agreement (Ecology et al. 1989). The M-91 facility is a facility that will be capable of handling and processing RHTRU waste.)

Certain bulky items that exceed the capacity of standard disposal facility containers (e.g., large metal objects, piping, concrete sections) may be packaged and shipped in accordance with the approved disposal facility waste acceptance criteria and procedures. Excavated waste designated to be disposed of at the WIPP site will be packaged and shipped in accordance with the appropriate waste-acceptance criteria documentation that is in place at the time of final off-site disposal. DOE/WIPP-02-3214 Rev. 0D, *Remote-Handled TRU Characterization Program Implementation Plan*, is currently pending approval. Shipment of U.S. Department of Transportation hazardous materials will comply with Title 49 CFR 173, "Shippers – General Requirements for Shipments and Packagings," or will require safety documentation demonstrating an equivalent degree of safety.

4.4.1 Waste Categories

Waste materials will be separated into the broad categories listed in Table 2 and described in the following subsections. Some materials classified as contaminated may require special handling, which will be dependent on the levels of contamination encountered.

Table 2. Potential Waste Categories. (2 Pages)

Waste Category	Definition/Criteria	Possible Disposal Pathway
Uncontaminated Material	Excavated material verified to have concentrations of RCRA constituents below land disposal restrictions and radiological activity below clean-up levels specified in the 300-FF-2 OU ROD (EPA/ROD/R10-01/119) and the 300-FF-2 OU ESD (EPA 2004).	Fill material
Hazardous/Dangerous Waste	Excavated material contaminated with chemical constituents of concentrations greater than regulatory and/or site-specific action levels	Treatment/Onsite mixed waste burial grounds
Low Level Waste (Class A, B, C and Greater than Class C)	Radioactive waste not classified as high-level radioactive waste, TRU waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the *Atomic Energy Act of 1954* (uranium or thorium tailings and waste).	ERDF
Low-Level Mixed Waste	Radioactive waste not classified as high-level radioactive waste, TRU waste, spent nuclear fuel, or byproduct material, and which is also	Treatment/ERDF

Table 2. Potential Waste Categories. (2 Pages)

Waste Category	Definition/Criteria	Possible Disposal Pathway
	contaminated with chemical constituents of concentrations greater than regulatory and/or site specific action levels.	
Contact-handled TRU	Material contaminated with radiological elements with atomic numbers higher than uranium (92) and which have a surface dose rate <200 mrem/h.	WIPP
Remote-handled TRU	Material contaminated with radiological elements with atomic numbers higher than uranium (92) and which have a surface dose rate ≥200 mrem/hour.	WIPP

Atomic Energy Act of 1954, 42 USC 2011, et seq.
EPA, 2004, *Explanation of Significant Differences for the 300-FF-2 Operable Unit Record of Decision.*
EPA/ROD/R10-01/119, *Declaration of the Interim Record of Decision for the 300-FF-2 Operable Unit.*

ERDF = Environmental Restoration Disposal Facility.
ESD = explanation of significant difference.
OU = operable unit.
RCRA = *Resource Conservation and Recovery Act of 1976.*
ROD = record of decision.
TRU = waste materials contaminated with >100 nCi/g of transuranic materials having half-lives longer than 20 years.
WIPP = Waste Isolation Pilot Plant.

4.4.1.1 Uncontaminated Material

Uncontaminated material includes cover and fill material excavated to gain access to contaminated material that is verified as containing no contamination or contaminant levels below RAGs. Uncontaminated material does not require packaging. Uncontaminated soil will be stockpiled for future use as backfill.

As specified in the 300-FF-2 OU ESD (EPA 2004), the 618-10 Burial Ground is required to be remediated to unrestricted land-use standards. Based on the 300-FF-2 OU ROD (EPA/ROD/R10-01/119), the 618-11 Burial Ground and the unplanned release site, UPR-600-22 are required to be remediated to industrial land-use standards, requirements that are less stringent than those required at the 618-10 Burial Grounds.. Therefore, material excavated from the 618-10 Burial Ground that has been verified to pass industrial risk-criteria levels may be considered uncontaminated material and could be considered for use as backfill material at the 618-11 Burial Ground.

Uncontaminated debris includes concrete, timbers, piping, wire, and miscellaneous materials that are verified to contain either no contamination or contaminant levels below RAGs. Uncontaminated debris either will be disposed of at an approved inert landfill location or will be used as backfill at the waste sites.

4.4.1.2 Contaminated Material

Contaminated soil material from excavations will consist of silts, sands, gravels, and cobble that exhibit properties in excess of the RAGs. Contaminated soil will be segregated from contaminated debris and containerized separately in accordance with the ERDF waste acceptance criteria, the WIPP waste acceptance criteria, or other designated disposal facility waste acceptance criteria. Contaminated debris includes, but is not limited to, structural concrete, timbers, pipe, laboratory waste, laboratory equipment, intact non-empty containers, batteries, wire, and similar materials that exhibit properties in excess of the RAGs. These materials will be evaluated to determine if decontamination is feasible.

Contractor and/or subcontractor-generated contaminated (project-generated), compacted trash consists of materials such as gloves, disposable suits, empty cans, empty barrels, and cardboard containers that exhibit properties in excess of cleanup levels. Contaminated, compactable trash will be accumulated and containerized separately from other contaminated materials in accordance with the ERDF waste acceptance criteria. Project-generated waste will be segregated to ensure that contaminated material is kept separate from uncontaminated material.

4.4.1.2.1 Contaminated Material Designated as Potentially Dangerous Waste

Contaminated material designated as potentially dangerous waste is that portion of contaminated material subject to verification as to whether it meets one or more of the dangerous waste designation criteria (WAC 173-303, "Dangerous Waste Regulations"). Contaminated material classified as potentially dangerous waste will be retained in the AOC, placed in a staging pile area, or placed in containers and transported to a designated dangerous-waste storage area within the onsite area. Final disposition of the material will depend on the results of the verification/designation process.

Material retained within the AOC does not have to meet the substantive requirements of RCRA. Dangerous waste placed in a staging pile area must meet the requirements of WAC 173-303. Dangerous waste stored in the onsite area is required to meet the substantive requirements of WAC 173-303, but not the administrative requirements of RCRA. The AOC and the onsite area will be determined through negotiations with the lead regulators.

4.4.1.2.2 Radiologically Contaminated Material

Radiologically contaminated materials may include soils and debris (e.g., intact containers, wood, metal, plastic, cardboard, concrete). Radioactive waste is managed as required by the contract requirements document in DOE O 435.1, *Radioactive Waste Management*, and will be retained in the AOC or may be transported to a designated Radioactive Materials Management Area within the project boundary for temporary storage, segregation, characterization, and/or packaging for shipment to a designated disposal facility or other processing facility. Radiological work controls, entry and exit requirements, control and monitoring of contamination, area postings, and release of materials from within the area are defined in HNF-5173. HNF-PRO-8366 will be used to prepare the hazard categorization for the interim onsite staging and storage facilities.

4.4.2 Waste Handling

At all sites, all containers and haul trucks will meet the exterior contamination limits of 100 mrem/h on the surface when released from the roped control area. A survey station is not a requirement at small or isolated sites; however, a method of surveying will be developed by appropriate field personnel. Highly contaminated material may require dedicated containers for packaging (e.g., shield by grouting) and disposal of material at an approved facility.

Container transfer facilities will be located near the excavation area and will be sized to accommodate, at a minimum, one and one half of a daily container production rate, with a minimum spacing of 1.2 m (4 ft) between the row of containers. The road into the facility will be sufficiently wide to safely accommodate two-way traffic with heavy tractor-trailer trucks. The loading/unloading surface area will be a minimum of 15.24 cm (6 in.) of compacted and crushed surface rock or gravel.

4.4.3 Waste Profile

The contractor will provide waste characterization and necessary transport papers. Waste profiling will take place concurrently with remediation activities. Field screening measurements will be used to obtain data to adjust the waste profile. The waste profile will be adjusted, as necessary, by performing a combination of field screening methods and analytical laboratory analysis. The data will be used to update waste profiles or to prepare waste profiles, as necessary.

A waste profile station will be located next to the excavation area and will be designed to provide comfortable access for transmitting waste tracking forms from the building to the driver of the hauling vehicle. The building will provide all-weather protection for workers and may include building access ramps, stairs, or platforms necessary for a working facility in addition to telecommunication capabilities necessary for completing the paperwork for transportation of the waste to the appropriate onsite facilities.

4.4.4 Waste Staging

Hazardous or mixed waste that is excavated and held for further analysis, treatment, or any other reason, will be managed within the AOC. The AOC approach is discussed in the NCP (55 FR 8666) with regards to remedial actions under CERCLA. The guidance states that the AOC can be equated to a RCRA landfill where movement within the area would be considered land disposal and would trigger the requirements of Subtitle C, such as the 90-day storage or land disposal restriction.

As an alternative to storage within the AOC, waste that is not immediately transported to offsite may be stored in staging piles. Staging piles are used only during remedial operations for temporary storage at a facility, and must be located within the contiguous property where the waste to be managed originated. The staging piles must not operate for more than 2 years (measured from the first time remediation waste is placed into the pile), except when the EPA grants an operating term extension. Ignitable or reactive waste must not be placed in a staging pile unless it has been treated or mixed before being placed in the pile so that the waste no longer meets the definition of ignitable or reactive, or the waste is managed in order to protect it from exposure to any material or condition that may cause it to ignite or react. Incompatible wastes may not be placed in the same staging pile, unless the requirements in 40 CFR 264.17(b) have been met. The incompatible materials must be separated or they must be protected from each other with a dike, berm, wall, or other device. Remediation waste may not be piled on the same base where incompatible wastes or materials were previously piled, unless the base has been decontaminated sufficiently to comply with 40 CFR 264.17(b).

Field operation of staging piles within the referenced regulatory provisions will be accomplished through the following controls:

- The staging pile area will be surrounded with a minimum of a 15-cm (6-in.) berm to control run-on/runoff prior to use.
- Dust control practices will be deployed consistent with soil piles managed in the AOC, including the use of crusting agents, as necessary, to minimize migration/leaching or contaminants into underlying soil.
- Surveys of the staging pile area will be performed prior to placement to ensure no cross-media transfer or staging of waste on previous contaminated areas.
- Gross sorting of waste will be performed within the AOC to identify and remove drums or other containers from the bulk soil prior to moving the soil to the staging piles. Additional sorting may be required on bulk soil in the staging pile area. Any dangerous waste identified will be packaged and managed appropriately (drums) within the staging pile area and within close proximity to the specific staging pile. Drums will be properly labeled, managed, and inspected weekly.

4.4.5 Treatment

Any material that does not meet the ERDF, WIPP, or designated disposal facility waste acceptance criteria, which includes land-disposal restrictions, will be stored on site, retained in the AOC or within staging piles until size reduced or treated to meet waste acceptance criteria. On a case-by-case basis, a staging area may be available at ERDF for drummed waste that require special handling and/or treatment not currently available. Materials sent to the interim staging area at ERDF will be stored in accordance with requirements prescribed by the ERDF ROD (EPA 2002).

When such waste material is discovered, disposition of the material will be agreed to and documented by EPA and DOE before the waste material can be treated and prepared for removal from the waste storage area. Treatment may be conducted at the site, at the ERDF (in special cases), or at an EPA-approved offsite facility. Treatment of dangerous waste material, if required, will be addressed as a separate work scope and is not included in the current design work.

Soils and/or debris contaminated with chemicals at levels exceeding waste disposal acceptance criteria, if any, will be treated by appropriate treatment technologies as defined in 40 CFR 268.42, "Treatment standards expresses as specified technologies" unless a treatability variance is approved by the EPA. Offsite treatment must be performed at a facility approved by the EPA in accordance with 40 CFR 300.440. Contaminated soil and/or contaminated products resulting from treatment technologies will be disposed of in the same manner as are other materials that meet waste acceptance criteria without treatment.

The selected remedy (interim action 300-FF-2 OU ROD [EPA/ROD/R10-01/119]) is removal, treatment (if required), and disposal. For purposes of the design basis, "treatment as required" has two main components:

- Treatment to reduce waste volume, thereby lowering remediation costs
- Treatment as a regulatory requirement (e.g., dangerous waste).

4.4.5.1 Volume Reduction

Waste volume reduction practices, such as minimizing cross-contamination during remedial action or segregation of clean overburden from contaminated materials, will be implemented where feasible.

4.4.5.2 Required Treatment

Treatment of soils may be required based on state and Federal dangerous waste regulations established in WAC 173-303-140, "Land Disposal Restrictions," and 40 CFR 268.

The treatment requirements for characteristic or criteria wastes will not be developed as part of remedial design. However, because characteristic or criteria waste may be encountered, dangerous waste will be temporarily stockpiled within the AOC, placed in staging piles, or stored in containers that meet the substantive requirements of the WAC 173-303 regulations. Once dangerous waste is confirmed, an appropriate treatment plan will be initiated that considers waste type(s) encountered, anticipated waste volumes, and associated treatment economics.

In addition, drums of pyrophoric material may be encountered. These drums may require treatment and/or stabilization prior to disposal. A separate plan will be developed and provided to the regulators for approval.

4.4.5.3 Stabilization

Waste materials may require stabilization to maintain worker exposure to airborne and/or direct radiation ALARA. Stabilization methods may include the use of grouts to encapsulate particulates and/or to provide shielding. Other methods of fixing contamination such as coatings or expandable foams also may be considered.

4.4.6 WASTE TRANSPORTATION

The transport of contaminated material requires reusable containers to be filled at the excavation site, surveyed and decontaminated, taken to an onsite storage area, and then transported directly to ERDF or to the WRAP facility or the M-91 facility for processing before they are sent to WIPP or another designated off-site disposal facility (e.g., Nevada Test Site, Yucca Mountain).

Based on its ability to satisfy the basic functional criteria, as well as its adaptability to large or small waste sites, the container option will be used as the design basis for handling contaminated soils and debris. To fulfill their intended purpose, the containers must satisfy the requirements listed in Table 3.

Table 3. Container Requirements. (2 Pages)

Facility	Container/Payload Requirements
WRAP	• Drums not exceeding 85 gal. • Standard waste boxes less than the dimensions specified in HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria.*
ERDF	Waste containers shall meet the U.S. Department of Transportation requirements under 49 CFR 173. Containers of steel construction will be lined with a minimum 0.15-mm (6-mil)-thick removable plastic liner. The liner will be sized to fit inside the container, to be folded over, and to completely surround the maximum container load. Approved ERDF waste containers include the following: • Plywood burial boxes (1.2 m [4 ft] long, 1.2 m [4 ft] wide, and 1.2 m [4 ft] tall; and/or 2.4 m [8 ft] tall, 1.2 m [4 ft] wide, and 1.2 m [4 ft] longl) • Metal box (1.5 m [5 ft] tall, 1.5 m [5 ft] wide, and 2.7 m [9 ft] long) • Steel drums (0.84 m [2.75 ft] tall and 0.56 m [1.8 ft] diameter; and/or 0.94 m [3.1 ft] tall and 0.66 m [2.2 ft] diameter) • ERDF bulk roll-off (1.5 m [5 ft] tall, 2.4 m [8 ft] wide, and 6.1 m [20 ft] long) • Connex box (2.4 m [8 ft] tall, 3.1 m [10 ft] wide, and 6.1 m [20 ft] long)
WIPP (CHTRU Waste)	Payload containers shall meet U.S. Department of Transportation Specification 7A, (49 CFR 178.350), Type A, packaging requirements.. Authorized payload containers include the following: • Standard pipe overpack (55-gal drum containing a six-in. diameter standard pipe component) • Standard 55-gal drums (direct load) • 85-gal drums (each overpacking one 55-gal drum). The term "85-gal drum" includes 79-, 83-, and 85-gal drums. • Standard waste boxes (either direct loaded, containing up to four 55-gal drums, or containing one bin) • Ten drum overpacks (either containing up to ten 55-gal drums, up to six 85-gal drums each overpacking one 55-gal drum, or one standard waste box). Shipping packages include the following: • Transuranic Package Transporter Model II (TRUPACT-II) (including 14 55-gal drums, 14 pipe overpacks, two standard waste boxes, or one ten-drum overpack) • HalfPACT (including seven 55-gal drums, seven standard pipe overpacks, four 85-gal drums (each overpacking one 55-gal drum), or one standard waste box).

Table 3. Container Requirements. (2 Pages)

Facility	Container/Payload Requirements
WIPP (RHTRU Waste)	The only approved payload container for shipment of RHTRU waste to WIPP are: • Standard 55-gal drums. • RH Canister (direct load). • RH Canister (containing 30- or 55-gal drums).
Nevada Test Site	Waste packages must meet applicable DOE orders, Title 10 *Code of Federal Regulations*, Title 40 *Code of Federal Regulations*, and Title 49 *Code of Federal Regulations* requirements. Acceptable packages include the following: • Boxes (1.2 x 1.2 1.2 m [4 x 4 x 7 ft] or 1.2 x 0.6 x 2.1 m [4 x 2 x 7 ft]) • 30-, 55-, 85-, or 110-gal drums • Cargo containers • Burrito wraps • Supersacks.

10 CFR, "Energy."
40 CFR, "Protection of Environment."
49 CFR, "Transportation."
49 CFR 178.350, "Specification 7A, General Packaging, Type A" U.S. Department of Transportation.
HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria.*

CHTRU = contact-handled transuranic waste.
ERDF = Environmental Restoration Disposal Facility.
TRUPACT-II = Transuranic Package Transporter Model II.
WIPP = Waste Isolation Pilot Plant.
WRAP = Waste Receiving and Packaging Facility.

To comply with the ERDF shipping requirements, the WIPP shipping requirements, and the Nevada Test Site shipping requirements, refer to the most current version of the facility waste acceptance criteria documents.

Material may be transferred directly to ERDF, the WRAP or M-91 facilities, WIPP, or other designated disposal facility using the existing transportation strategy for each disposal/transfer facility. Vehicles and equipment traveling on primary roadways will be required to meet Federal, state, and local requirements. Before leaving a remediation site, any vehicle that enters a contaminated area will be surveyed and decontaminated as necessary.

Roads constructed to provide access to haul vehicles should have a minimum width of 4.0 m (13.1 ft), maximum grade of 8 percent, and a minimum turning radius of 30.5 m (100 ft). Locations of interferences and other transportation limitations will be shown on the project drawings.

Drummed contamination will be excavated from the burial ground, overpacked as necessary, and staged in control areas for transportation to the ERDF, WIPP, or other approved disposal site. Drums will be transported on U.S. Department of Transportation-approved tractor-trailer flatbeds, in accordance with U.S. Department of Transportation standards.

4.5 QUALITY ASSURANCE

The HNF-MP-599, *Quality Assurance Program Description*, and HNF-PRO-261, *Quality Assurance Program Plans*, define the quality management system implemented by the project team. HNF-MP-599, in combination with the controlled manuals listed below, provides a quality assurance program designed to comply with the requirements outlined in DOE/RL-99-40; the Tri-Party Agreement (Ecology et al. 1989); and state and local regulations. All work performed by the project team will be in compliance with the following Fluor Hanford requirements and approved procedures, or as deemed necessary by the project engineer:

- HNF-5054, *Fluor Hanford Environmental Policy*
- HNF-5173, *PHMC Radiological Control Manual*
- HNF-20635, *Groundwater Remediation Project Quality Assurance Project Plan*
- HNF-GD-8257, *Engineering Design*
- HNF-GD-8260, *Chemical and Waste Management Interface*
- HNF-MP-003, *Integrated Environment, Safety, and Health Management System Description*
- HNF-MP-599, *Quality Assurance Program Description*
- HNF-POL-PROCEDURE, *Procedure Compliance Expectations*
- HNF-PRO-261, *Quality Assurance Program Plans*
- HNF-PRO-459, *Environmental Training*
- HNF-PRO-15333, *Environmental Protection Processes*
- HNF-PRO-15335, *Environmental Permitting and Documentation Preparation*
- HNF-RD-7900, *Transportation and Packaging Program Requirements*
- HNF-RD-8524, *Supervision of Fieldwork*
- HNF-RD-11408, *Property Management Requirements*
- HNF-RD-15332, *Environmental Protection Requirements*
- HNF-SD-WM-QAPP-036, *Waste Management Project Quality Assurance Program Plan.*

The development of subcontract technical requirements for the selected site remediation will follow the general guidelines established in this document. These performance requirements will be expanded during the development of the appropriate subcontract exhibits. These exhibits will outline the appropriate commercial codes, standards, laws, and regulations required to be followed by the remedial action subcontractor in the performance of its work scope.

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